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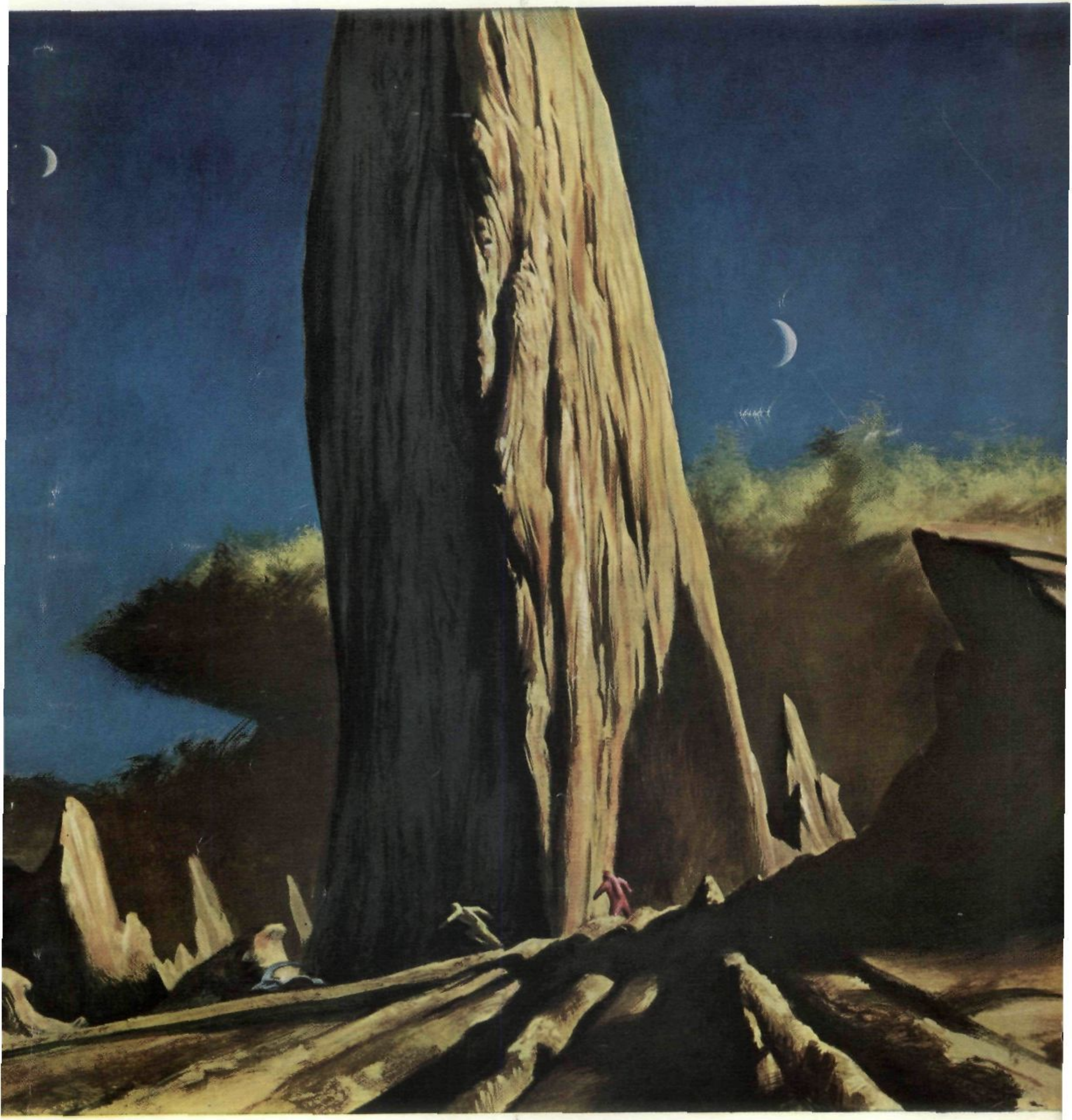

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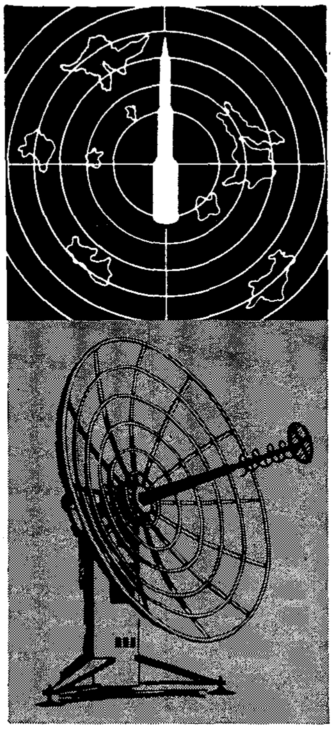

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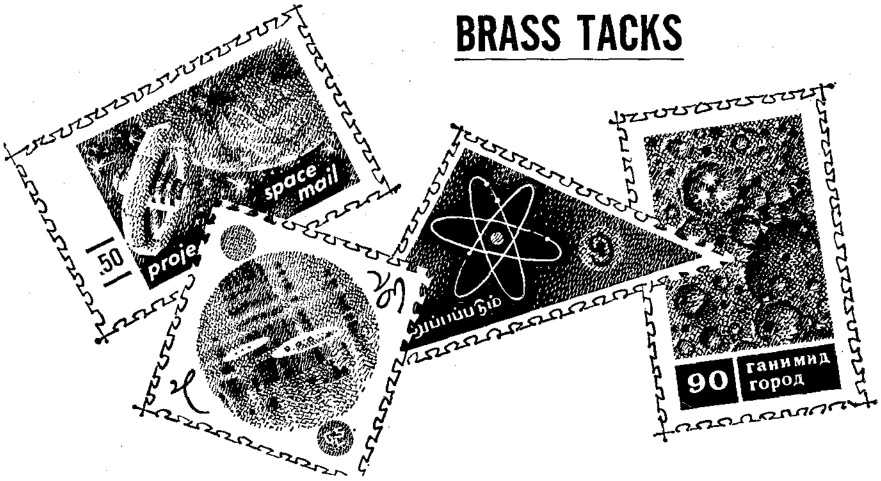

Dear Mr. Campbell:

At the end of Dr. Harry C. Schnur's letter in the September issue of Analog, I find the following little note that you seem to have appended: "O.K. friend—argue the meaning of 'living language' with the Esperantists!"

I don't quite understand the meaning of this. I have been an Esperantist for several years now—reading, writing, and *speaking* the language—and I cannot really say that I can find any disagreement between my idea of a "living language" and what would appear to be that of Dr. Schnur. The implication, I suppose, is that neither Esperanto nor Latin can be termed a "living language."

The whole matter seems to be one of definition. My definition—and probably Dr. Schnur's—can be summed up by the statement: "A living language is a language with living people speaking it." This is the simplest, most logical, and, by implication of the term "living language" itself, probably the most acceptable definition. It includes all the ethnic—what you would call "natural"—languages from Mandarin Chinese down to the most obscure South American Indian dialect, while excluding languages such as ancient Sumerian, Hittite, Gothic and the vernacular used by Ug the caveman's son. It also includes Latin—by virtue of Dr. Schnur's letter and the Catholic Church—and Esperanto. (To this I can attest, from experience).

Of course, there is something about the make-up of the average uninformed human being that makes him cry out "Esperanto? Esperanto *can't* be a living language—it's *artificial!* And Latin isn't either!" And he immediately starts adding provisos to the definition. "Well . . . uh . . ." he begins, this being the way his mental motor turns over, ". . . Uh . . . a living language has got to have a literature. *Modern* literature," he adds, remembering Caesar and Ovid and Livy from his school days.

And Dr. Schnur will say, "(Latin is) a language in which original creative poetry is written." And your average Esperantist will add, "And you ought to see some of *my* work. And don't forget Auld, Baghy, Kalocsay, Boulton, Su, Schwartz, Forge, Beaupierre . . . Szathmari is good, too, and Waringhien's latest book on linguistics makes excellent light reading . . ."

"Never heard of 'em," replies Mr. Averageman, who has also never heard of Lagerlöf, Lägerkvist, Tagore, Andrich, Vazov, Madach, or anybody else outside his own particular language. "And besides, a living language has got to have a . . . uh . . . an evolving vocabulary. Yeah, that's it!"

So Dr. Schnur will point out the facts about the updating of Latin (an ancient Roman, for instance, would not have known the significance of *pyropolus*—but we do in today's world, only too well!) and the average Esperantist will mention good old Rule 15 of the Esperanto grammar, i.e., that "foreign words," when sufficiently international, automatically become a part of the language, changing only to adopt its orthography—so we have "randaro," "sputniko," "kosmonauto," "meteologio," imperialismo" or (for conservative Esperantists) "imperiismo," et cetera. And I'm sure that Dr. Zamenhof never invented the word "atombombo" or the related word "reaktoro."

Or take your word, "to larb." If, through some strange quirk of fate, that got into common use in the English language, and the French began to say "larbir" and the Spanish "larbar," the Germans "larben" and the Italians "larbare," the Russians "larbit" and the Danes "at larbe," then the Latinist group mentioned by Dr. Schnur would probably just adopt something like "larbo, larbare, larbavi, larbatus," and we Esperantists would just start saying "larbi."

It should also be pointed out that these two excess criteria would exclude about ninety-five per cent of the world's languages from the classification "living language."

So it can be seen that, basically, there is no argument between Esperantists and Latinists about the term "living language." The argument comes when we turn to uninformed laymen. And for this reason, may I add my voice to Dr. Schnur's; when he says *ne sutor ultra crepidam*, I would add *ni fosu nian sulkon*, which, although it does not mean "Cobbler, stick to thy last," has approximately the same significance.

Donald J. Harlow
2137 Shielah Way,
Sacramento 22, California 95822

A thoroughly interesting defense of your position, Sir! But how about this definition of a "living language": A living language is one used in earning a daily living other than as a professional scholar. (That exception to exclude Chaldean, Mayan, and Ugson's vernacular.) In view of the rituals of the Catholic Church, I guess that does make Latin a living language, though . . .

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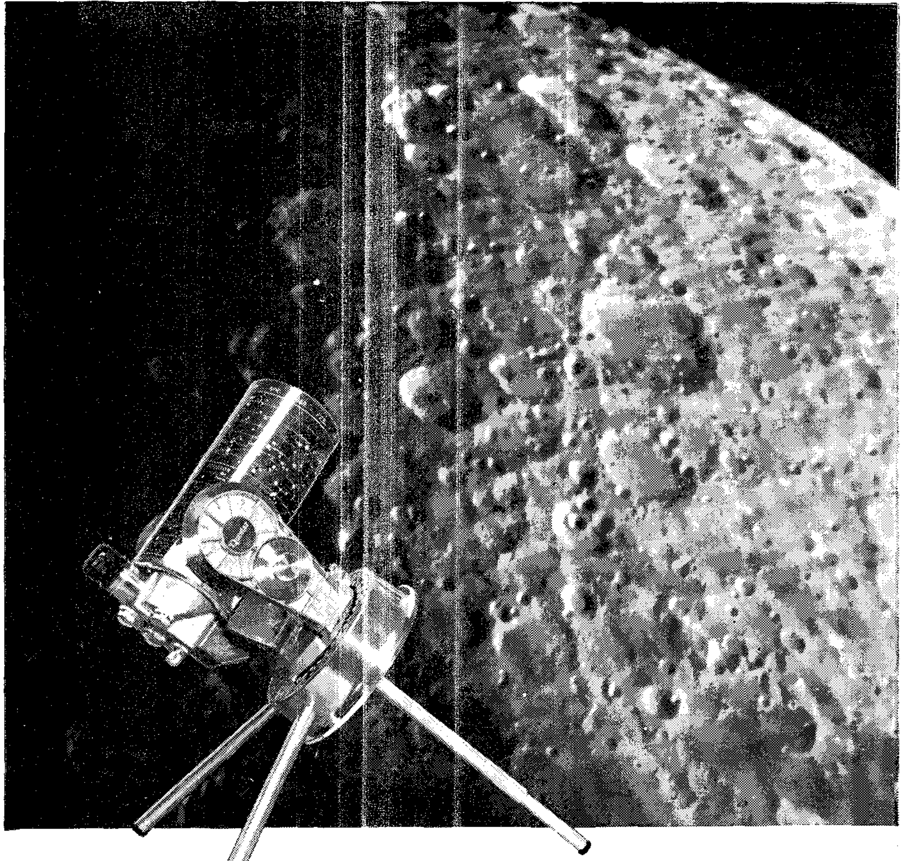

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Excepting this final paragraph, this whole advertisement was prepared by the International Nickel Company, Inc., 67 Wall St., New York 5, N.Y. They ran this page in the February 10th issue of Business Week, circulation 400,000. Wasn't that nice of them? We think so, and because we think it splendid for our product, the versatile Questar, we repeat it here. Questars cost $995. May we send our 32-page booklet?

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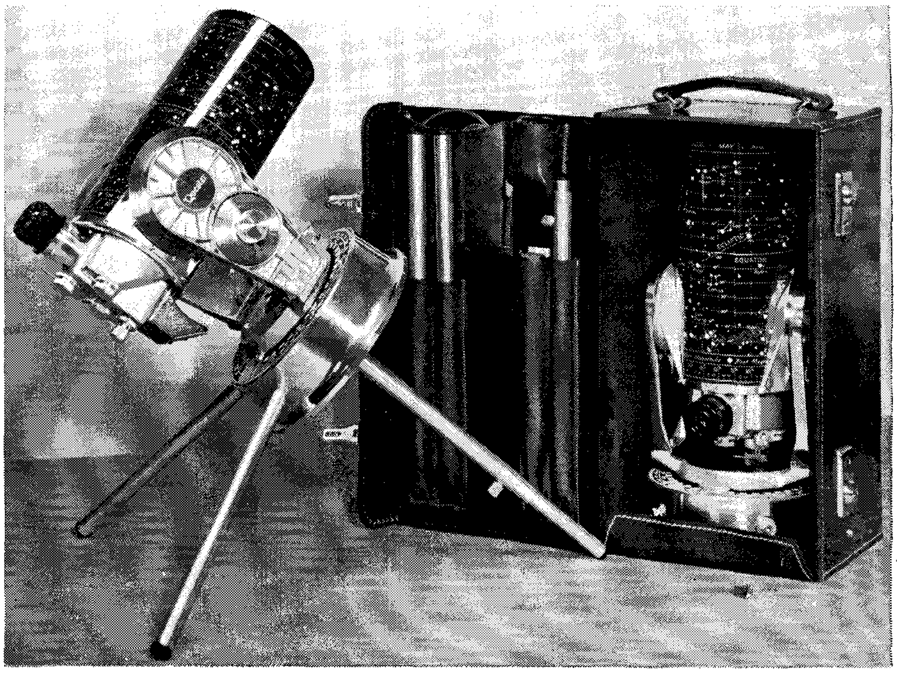

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HYDROGEN ISN'T CULTURAL

EDITORIAL BY JOHN W. CAMPBELL

In the February 1957 issue of Astounding Science Fiction, H. Beam Piper had a story "Omnilingual" concerning the translation of the Martian language, found in the 50,000-plus year-old ruins. The anthropologists and linguists insisted that, since there could be no Rosetta Stone bilingual key, relating the unknown Martian writings to a known language, no translation would be possible.

Piper had a very simple, but enormously powerful point to make; the Martians had had a highly developed technology of chemistry, electricity, mechanics, et cetera. And chemistry is not a matter of cultural opinion; it's a matter of the "opinion" of the Universe. It makes not the slightest difference whether you're a Martian, a Russian, an American, or an inhabitant of the fourth planet of a KO star in the Lesser Magellanic Cloud; hydrogen behaves in one, and only one way. Because the term "hydrogen" is a human-language symbol for a specific set of behavior characteristics, and, in this universe, that set of behavior characteristics requires the interaction of a single proton and a single electron in an atomic structure. (There may be 0, 1, or 2 neutrons with only minute variations of the chemical properties, though the resultant nuclear characteristics are widely different.)

Any highly developed technology of chemistry will have a term referring to that pattern-of-charcteristics; it *has* to have. The pattern of characteristics is a function not of the culture, but of the Universe itself. Whether you call a certain element "sauerstoff" or "oxygen" makes no difference; the behavior characteristics of the hydride of that element will remain the same.

Technically, under international agreement, there is no such element as "tungsten" any more—but the metal they use for incandescent lamp filaments maintains the same characteristic of phenomenally high melting point, whether it be called "tungsten" or "wolfram." No alien-star culture can develop a chemical system in which that element dissolves in dilute sulfuric acid and melts at 1100°C.; the laws of the Universe, not the agreements of intelligent entities is involved.

Perhaps the scientists working on the problem of cracking the genetic code should take time out to read H. Beam Piper's story. It might help in understanding one of the "mysteries of the genetic code" that has been discovered recently.

The communication system of genetics appears to be based on information encoded in the very complex arrangement of amino acid units in the giant molecules of deoxyribonucleic acid—DNA. A great deal of work has been done on some of the simpler, and more tractable organisms—microorganisms usually, because they're cheap, reproduce rapidly, and are "the small economy size."

The colon bacillus has been a favorite; it's hardy, handy, and prolific and—which is *not* an unimportant consideration!—it's not a dangerously lethal organism.

Certain "codons," or groupings of three-bases-together, are "words" in the "language" of genetics. There are

continued on page 84

The following text is taken verbatim from a leather-covered book, published in 1833, in Hartford, Connecticut, by D. F. Robinson & Co. The author I cannot determine, since the title page of the book has been ripped diagonally, and the exact title of the work, and the author's name is lost. There appears to have been an introduction, since the text begins on page 11—but that, too, is lost.

It's impossible to publish the entire three-hundred-fifty-page textbook of course—but I strongly suggest that it would be of great benefit to all modern technical schools, their professors and their students to study such a book of that period. The author was writing at a time when some of the greatest work in the advance of chemistry was going on; he was, roughly, thirty years before Mendeljeff, and thirty years after Galvani. Electrochemistry had just begun, but ammeters and voltmeters hadn't yet come into use.

The author was a sound, clear, and straight-forward thinker, and an excellent experimentalist. Page 11 begins with a discussion of *caloric*. "*Caloric* is the matter, or principle of heat, while heat is the sensation produced by the transfer of this principle to the living system from some body hotter than itself. Caloric is imponderable; that is, there is no appreciable difference in the weight of a body, whether it be hot or cold." And he has a series of clear, well-described experiments to demonstrate the truth of that scientific fact.

Our ancestors were not fools; this account below is the work of a scientist of first caliber in his own day; the mysteries he stumbles over are very simple and obvious to us, today. Not like the really hard problems, the really mysterious phenomena *we* have to deal with today, of course . . . *we* think!

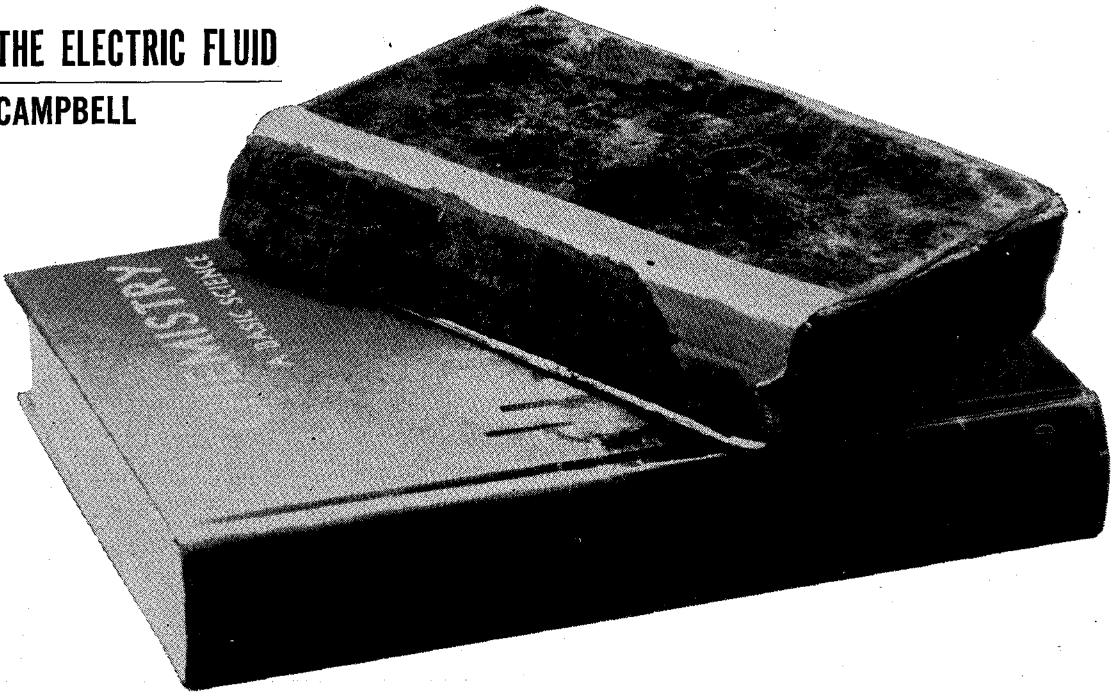
To state in a modern textbook, "In 1833 it was believed that heat was a material fluid that seeped through ordinary materials," does not express the problem. *Why* did they think that? What was their evidence? What led them to such a weird idea, anyway . . .?

It's uncomfortable for a modern scientist to review that aspect; their evidence then, when read from the viewpoint of one of the scientists of that time, sounds so distressingly like the evidence on which our Great And Proven Principles are based.

For the record—these are the facts of the Electric Fluid, as viewed from the knowledge of a competent professor of science, circa 1832 A.D.

THE NATURE OF THE ELECTRIC FLUID

JOHN W. CAMPBELL



CALORIC.

Heat is the sensation which one feels when he touches a body hotter than the hand; and this sensation is caused by the passage of *caloric* from the hot body to the hand. Thus caloric is the cause of the sensation which we call heat, and heat is the effect of the passage of caloric into the hand. Caloric, then, is the *matter*, or *principle* of heat, while heat is the sensation produced by the transfer of this principle to the living system, from some body hotter than itself.

Caloric is imponderable; that is, there is no appreciable difference in the weight of a body, whether it is hot or cold.

This principle seems to be present in all bodies, nor is there ny known process by which it can be separated from any bstance. For since heat constantly passes from the hotter the colder body, until every thing in the same vicinity mes of an equal temperature, so if we take a substance at perature however low, and carry it to a place where the ature is still lower, this substance will give out heat temperature becomes the same with that of the sur- air. For instance, if a piece of ice at 32 degrees ture, could be transported to any place, as in Si- the temperature is 60 degrees below 32, then e will continue to emit caloric until its tempe- only equal to that of the surrounding atmos- uld therefore give out 60 degrees of heat. ious to any one, that if a piece of iron, or be carried from the open air on a sum- heat is 92, to an ice house, where the iron will continue to part with its e same temperature with the ice, short time, lose 60 degrees o meter.

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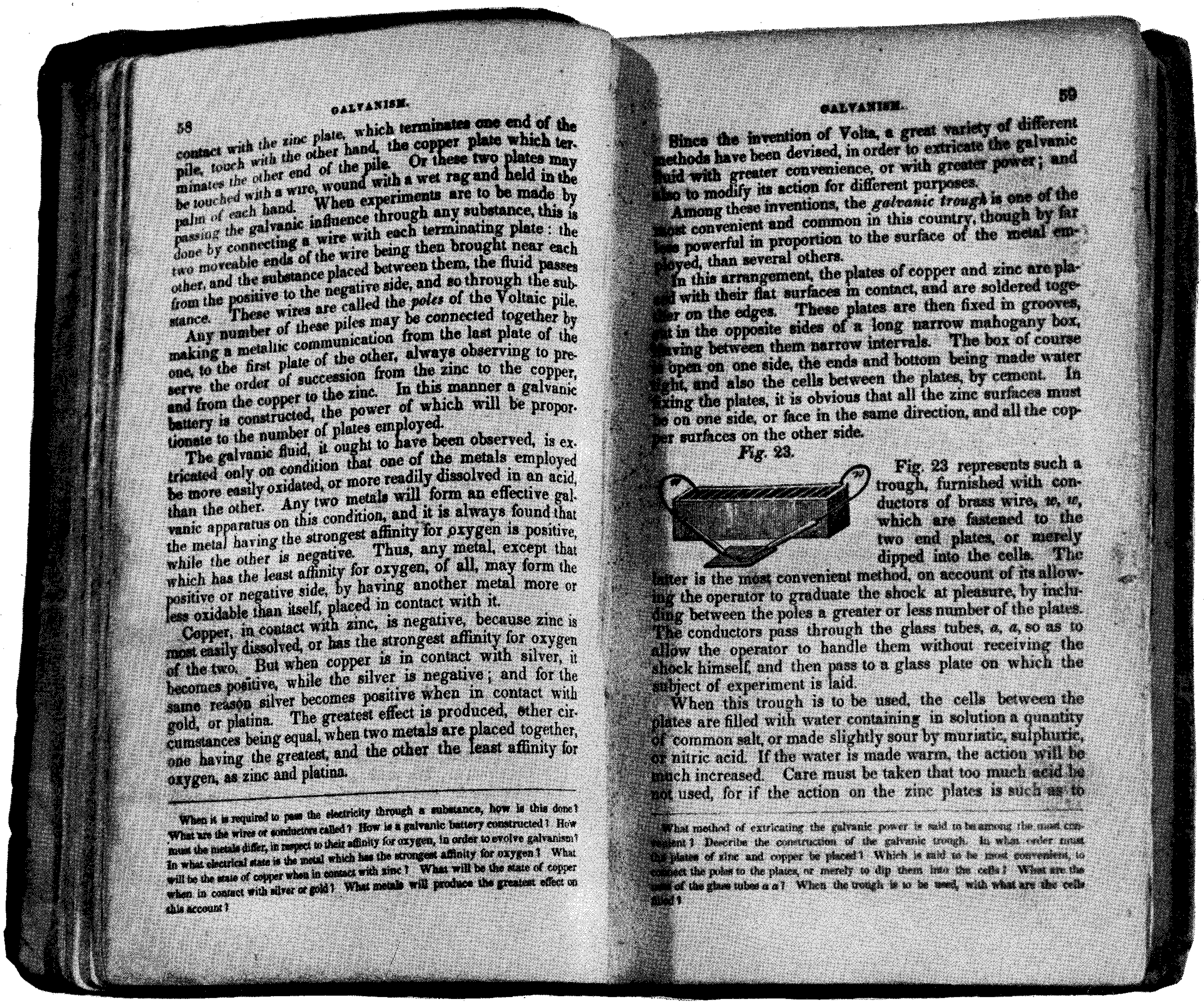

GALVANISM.

58

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other, and the positive to the negative side, and so through the sub-
from the These wires are called the *poles* of the Voltaic pile.
stance.
These piles may be *connected* together by
Any number of these piles may be connected together by
making a metallic communication from the last plate of the
one, to the first plate of the other, always observing to pre-
serve the order of succession from the zinc to the copper,
and from the copper to the zinc. In this manner a galvanic
battery is constructed, the power of which will be propor-
tionate to the number of plates employed.
The galvanic fluid, it ought to have been observed, is ex-
tricated only on condition that one of the metals employed
be more easily oxidated, or more readily dissolved in an acid,
than the other. Any two metals will form an effective gal-
vanic apparatus on this condition, and it is always found that
the metal having the strongest affinity for oxygen is positive,
while the other is negative. Thus, any metal, except that
which has the least affinity for oxygen, of all, may form the
positive or negative side, by having another metal more or
less oxidable than itself, placed in contact with it.
Copper, in contact with zinc, is negative, because zinc is
most easily dissolved, or has the strongest affinity for oxygen
of the two. But when copper is in contact with silver, it
becomes positive, while the silver is negative; and for the
same reason silver becomes positive when in contact with
gold, or platina. The greatest effect is produced, other cir-
cumstances being equal, when two metals are placed together,
one having the greatest, and the other the least affinity for
oxygen, as zinc and platina.

When it is required to pass the electricity through a substance, how is this done?
What are the wires or conductors called? How is a galvanic battery constructed? How
must the metals differ, in respect to their affinity for oxygen, in order to evolve galvanism?
In what electrical state is the metal which has the strongest affinity for oxygen? What
will be the state of copper when in contact with zinc? What will be the state of copper
when in contact with silver or gold? What metals will produce the greatest effect on
this account?

GALVANISM.

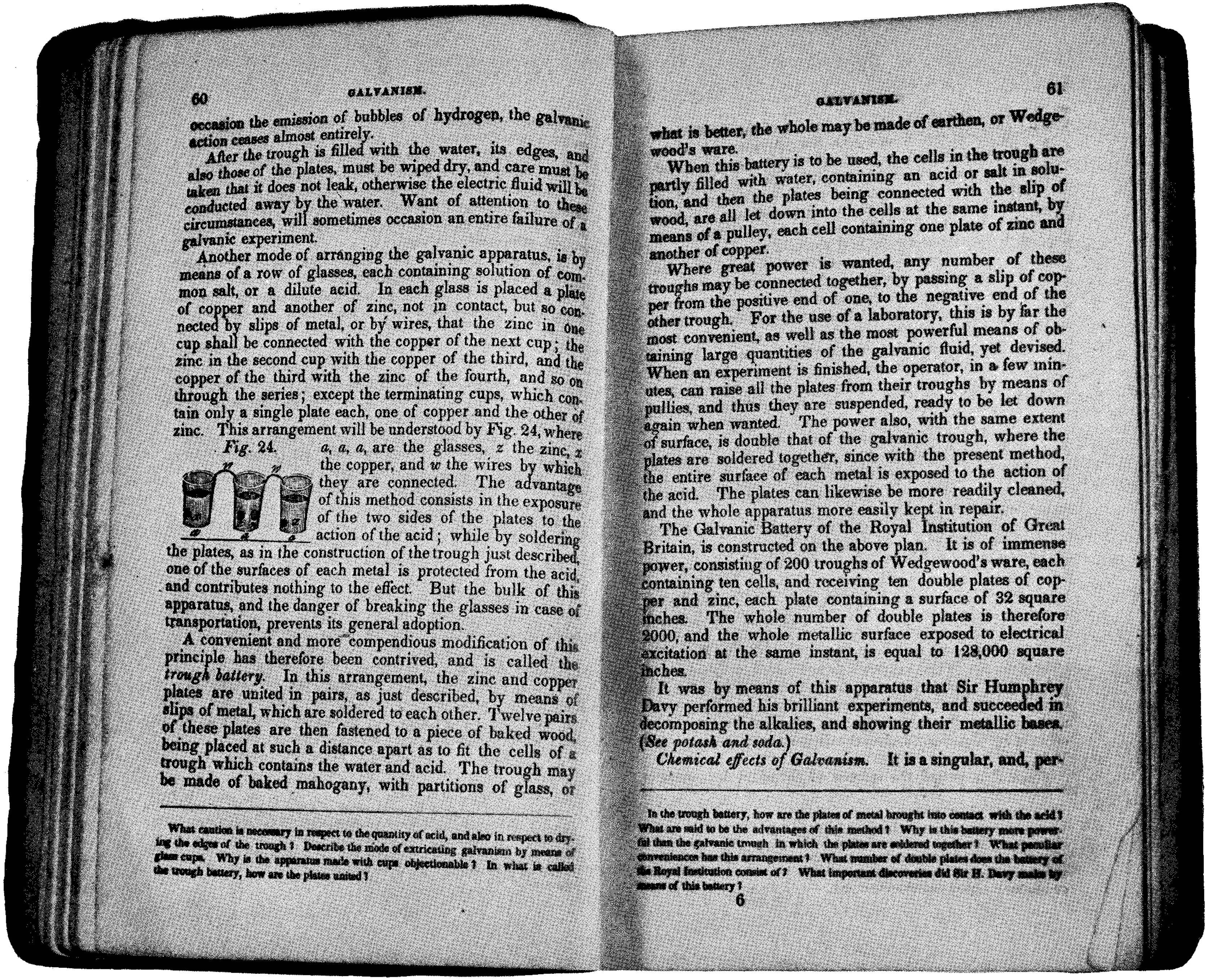
59

Since the invention of Volta, a great variety of different
ethods have been devised, in order to extricate the galvanic
uid with greater convenience, or with greater power; and
lso to modify its action for different purposes.
Among these inventions, the *galvanic trough* is one of the
ost convenient and common in this country, though by far
ss powerful in proportion to the surface of the metal em-
ployed, than several others.
In this arrangement, the plates of copper and zinc are pla-
d with their flat surfaces in contact, and are soldered toge-
r on the edges. These plates are then fixed in grooves,
t in the opposite sides of a long narrow mahogany box,
ving between them narrow intervals. The box of course
open on one side, the ends and bottom being made water
ght, and also the cells between the plates, by cement. In
xing the plates, it is obvious that all the zinc surfaces must
e on one side, or face in the same direction, and all the cop-
er surfaces on the other side.

Fig. 23.

Fig. 23 represents such a
trough, furnished with con-
ductors of brass wire, *w*, *w*,
which are fastened to the
two end plates, or merely
dipped into the cells. The
tter is the most convenient method, on account of its allow-
ng the operator to graduate the shock at pleasure, by inclu-
ding between the poles a greater or less number of the plates.
The conductors pass through the glass tubes, *a*, *a*, so as to
allow the operator to handle them without receiving the
shock himself, and then pass to a glass plate on which the
subject of experiment is laid.
When this trough is to be used, the cells between the
plates are filled with water containing in solution a quantity
of common salt, or made slightly sour by muriatic, sulphuric,
or nitric acid. If the water is made warm, the action will be
much increased. Care must be taken that too much acid be
not used, for if the action on the zinc plates is such as to

What method of extricating the galvanic power is said to be among the most con-
venient? Describe the construction of the galvanic trough. In what order must
the plates of zinc and copper be placed? Which is said to be most convenient, to
connect the poles to the plates, or merely to dip them into the cells? What are the
uses of the glass tubes *a a*? When the trough is to be used, with what are the cells
filled?



60 GALVANISM.

occasion the emission of bubbles of hydrogen, the galvanic action ceases almost entirely.

After the trough is filled with the water, its edges, and *also those* of the plates, must be wiped dry, and care must be taken that it does not leak, otherwise the electric fluid will be conducted away by the water. Want of attention to these circumstances, will sometimes occasion an entire failure of a galvanic experiment.

Another mode of arranging the galvanic apparatus, is by means of a row of glasses, each containing solution of common salt, or a dilute acid. In each glass is placed a plate of copper and another of zinc, not in contact, but so connected by slips of metal, or by wires, that the zinc in one cup shall be connected with the copper of the next cup; the zinc in the second cup with the copper of the third, and the copper of the third with the zinc of the fourth, and so on through the series; except the terminating cups, which contain only a single plate each, one of copper and the other of zinc. This arrangement will be understood by Fig. 24, where

Fig. 24.

a, a, a, are the glasses, *z* the zinc, *z* the copper, and *w* the wires by which they are connected. The advantage of this method consists in the exposure of the two sides of the plates to the action of the acid; while by soldering the plates, as in the construction of the trough just described, one of the surfaces of each metal is protected from the acid, and contributes nothing to the effect. But the bulk of this apparatus, and the danger of breaking the glasses in case of transportation, prevents its general adoption.

A convenient and more compendious modification of this principle has therefore been contrived, and is called the *trough battery*. In this arrangement, the zinc and copper plates are united in pairs, as just described, by means of slips of metal, which are soldered to each other. Twelve pairs of these plates are then fastened to a piece of baked wood, being placed at such a distance apart as to fit the cells of a trough which contains the water and acid. The trough may be made of baked mahogany, with partitions of glass, or

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What caution is necessary in respect to the quantity of acid, and also in respect to drying the edges of the trough? Describe the mode of extricating galvanism by means of glass cups. Why is the apparatus made with cups objectionable? In what is called the trough battery, how are the plates united?

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what is better, the whole may be made of earthen, or Wedgewood's ware.

When this battery is to be used, the cells in the trough are partly filled with water, containing an acid or salt in solution, and then the plates being connected with the slip of wood, are all let down into the cells at the same instant, by means of a pulley, each cell containing one plate of zinc and another of copper.

Where great power is wanted, any number of these troughs may be connected together, by passing a slip of copper from the positive end of one, to the negative end of the other trough. For the use of a laboratory, this is by far the most convenient, as well as the most powerful means of obtaining large quantities of the galvanic fluid, yet devised. When an experiment is finished, the operator, in a few minutes, can raise all the plates from their troughs by means of pullies, and thus they are suspended, ready to be let down again when wanted. The power also, with the same extent of surface, is double that of the galvanic trough, where the plates are soldered together, since with the present method, the entire surface of each metal is exposed to the action of the acid. The plates can likewise be more readily cleaned, and the whole apparatus more easily kept in repair.

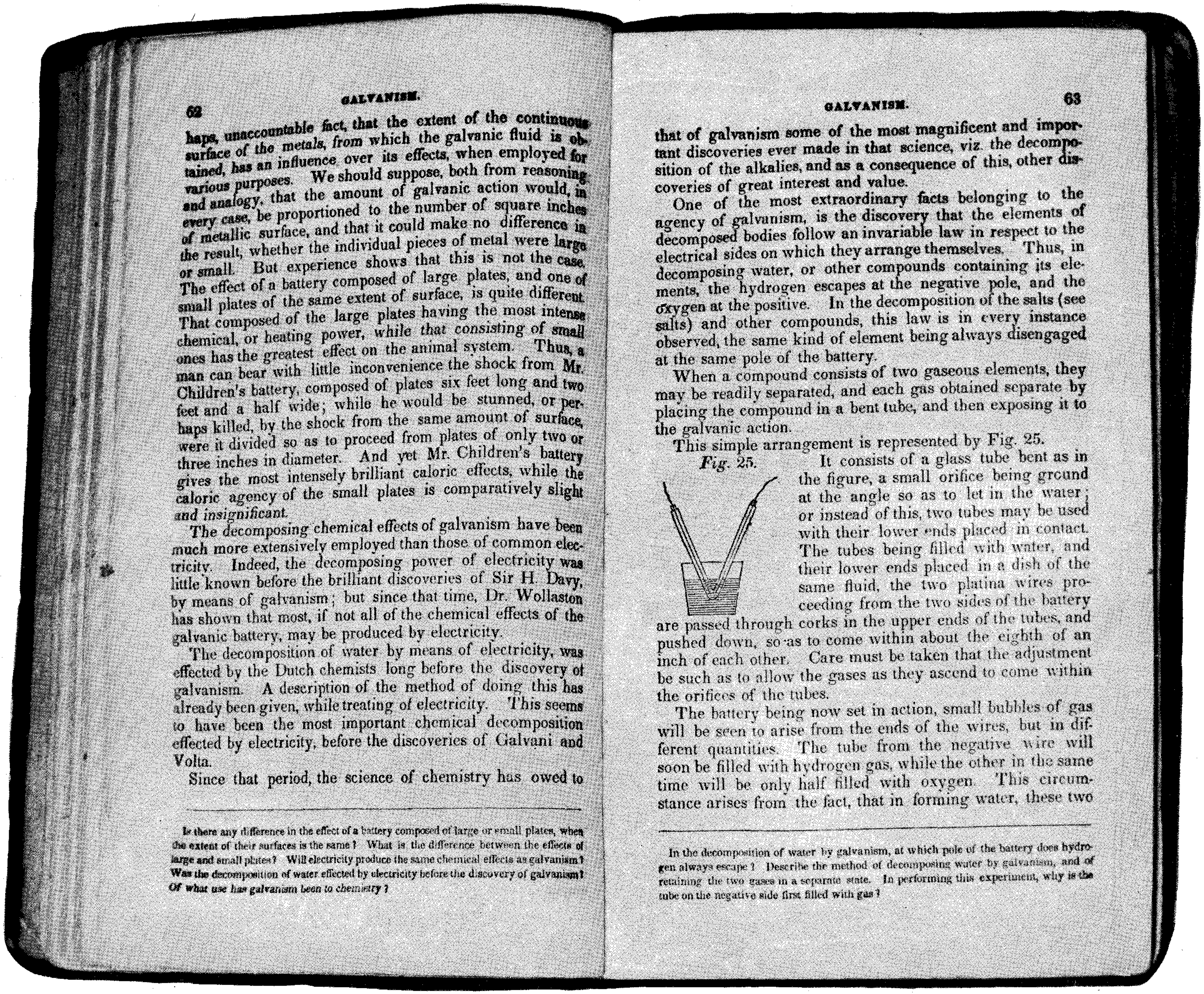
The Galvanic Battery of the Royal Institution of Great Britain, is constructed on the above plan. It is of immense power, consisting of 200 troughs of Wedgewood's ware, each containing ten cells, and receiving ten double plates of copper and zinc, each plate containing a surface of 32 square inches. The whole number of double plates is therefore 2000, and the whole metallic surface exposed to electrical excitation at the same instant, is equal to 128,000 square inches.

It was by means of this apparatus that Sir Humphrey Davy performed his brilliant experiments, and succeeded in decomposing the alkalies, and showing their metallic bases. (*See potash and soda.*)

Chemical effects of Galvanism. It is a singular, and, per-

In the trough battery, how are the plates of metal brought into contact with the acid? What are said to be the advantages of this method? Why is this battery more powerful than the galvanic trough in which the plates are soldered together? What peculiar conveniences has this arrangement? What number of double plates does the battery of the Royal Institution consist of? What important discoveries did Sir H. Davy make by means of this battery?

6



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haps, unaccountable fact, that the extent of the continuous surface *of the metals, from* which the galvanic fluid is obtained, has an influence over its effects, when employed for various purposes. We should suppose, both from reasoning and analogy, that the amount of galvanic action would, in every case, be proportioned to the number of square inches of metallic surface, and that it could make no difference in the result, whether the individual pieces of metal were large or small. But experience shows that this is not the case. The effect of a battery composed of large plates, and one of small plates of the same extent of surface, is quite different. That composed of the large plates having the most intense chemical, or heating power, *while that consisting* of small ones has the greatest effect on the animal system. Thus, a man can bear with little inconvenience the shock from Mr. Children's battery, composed of plates six feet long and two feet and a half wide; while he would be stunned, or perhaps killed, by the shock from the same amount of surface, were it divided so as to proceed from plates of only two or three inches in diameter. And yet Mr. Children's battery gives the most intensely brilliant caloric effects, while the caloric agency of the small plates is comparatively slight *and insignificant.*

The decomposing chemical effects of galvanism have been much more extensively employed than those of common electricity. Indeed, the decomposing power of electricity was little known before the brilliant discoveries of Sir H. Davy, by means of galvanism; but since that time, Dr. Wollaston has shown that most, if not all of the chemical effects of the galvanic battery, may be produced by electricity.

The decomposition of water by means of electricity, was effected by the Dutch chemists long before the discovery of galvanism. A description of the method of doing this has already been given, while treating of electricity. This seems to have been the most important chemical decomposition effected by electricity, before the discoveries of Galvani and Volta.

Since that period, the science of chemistry has owed to

Is there any difference in the effect of a battery composed of large or small plates, when the extent of their surfaces is the same? What is the difference between the effects of large and small plates? Will electricity produce the same chemical effects as galvanism? Was the decomposition of water effected by electricity before the discovery of galvanism? *Of what use has galvanism been to chemistry?*

GALVANISM. 63

that of galvanism some of the most magnificent and important discoveries ever made in that science, viz. the decomposition of the alkalies, and as a consequence of this, other discoveries of great interest and value.

One of the most extraordinary facts belonging to the agency of galvanism, is the discovery that the elements of decomposed bodies follow an invariable law in respect to the electrical sides on which they arrange themselves. Thus, in decomposing water, or other compounds containing its elements, the hydrogen escapes at the negative pole, and the oxygen at the positive. In the decomposition of the salts (see salts) and other compounds, this law is in every instance observed, the same kind of element being always disengaged at the same pole of the battery.

When a compound consists of two gaseous elements, they may be readily separated, and each gas obtained separate by placing the compound in a bent tube, and then exposing it to the galvanic action.

This simple arrangement is represented by Fig. 25.

Fig. 25.

It consists of a glass tube bent as in the figure, a small orifice being ground at the angle so as to let in the water; or instead of this, two tubes may be used with their lower ends placed in contact. The tubes being filled with water, and their lower ends placed in a dish of the same fluid, the two platina wires proceeding from the two sides of the battery are passed through corks in the upper ends of the tubes, and pushed down, so as to come within about the eighth of an inch of each other. Care must be taken that the adjustment be such as to allow the gases as they ascend to come within the orifices of the tubes.

The battery being now set in action, small bubbles of gas will be seen to arise from the ends of the wires, but in different quantities. The tube from the negative wire will soon be filled with hydrogen gas, while the other in the same time will be only half filled with oxygen. This circumstance arises from the fact, that in forming water, these two

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In the decomposition of water by galvanism, at which pole of the battery does hydrogen always escape? Describe the method of decomposing water by galvanism, and of retaining the two gases in a separate state. In performing this experiment, why is the tube on the negative side first filled with gas?

CRACKING THE CODE

CARL A. LARSON

Peaceful intercourse and combative ventures have taxed all means of transmitting and interpreting information. As a consequence, the last two decades have seen the birth and luxuriant growth of an elaborate communication theory. Tools of this science have recently been applied to problems of vital significance to all of us, with some unexpected implications for our survival on this planet and our future in the home galaxy.

Readers of this magazine will not be caught by surprise when messages from alien worlds are received and interpreted. Apart from the probings of artistic fantasy we have gotten acquainted with suggestive evidence for extraterrestrial life. Current theories not only admit of earthlike conditions in distant worlds, but make the denial of such life-sustaining environments a statistically unsound proposition.

Then the possibility of life forms, older and more mature than mankind, has to be taken into account. It may be that distance is no obstacle to a close scrutiny of human activities by intelligent neighbors in space—with a technology beyond anything we know now.

Earthbound beings may harbor some misgivings as to the outcome of such scrutiny. To carriers of an evolved civilization we may seem ineligible as associates, because of our crude manners—or simply because we cannot communicate with a profoundly different class of beings.

Or can we? It may be a question of incentive. We need no strong motive to pass the time of the day with our neighbor. Lack of shared experiences and language barriers breed impediments to human understanding; when the barbarian becomes our ally such inconveniences are brushed aside. It is something else again to try and communicate with living creatures with totally other senses and other concepts.

Inventive fantasy would have it that galactic neighbors put us to some kind of test. We may lack a score of their faculties, but we could show our maturity by some feat of intellect. Then we would be acceptable as associates.

Our handling of fissionable material and our space probing may proclaim a highly developed technology. We cannot feel confident that such feats of human prowess will impress our neighbors in a positive direction. Tricks of space athletics may seem rather rude when viewed by refined spectators . . .

Perhaps we could convince intelligent neighbors in distant worlds of our fitness to appear in decent society if we could surmount conceptual difficulties in communication problems close at hand. Students of the bottlenose dolphin of the east coast of the United States have registered a complex system of signals, consisting of whistles, clicks, quacks, squawks and blats, used for communication with fellow dolphins. To some extent such signals are interpretable in relation to specific situations.

So far the two species, *Homo sapiens* and *Tursiops truncatus Montagu,* have not been able to iron out their communication difficulties though both are socially organized mammals and quick learners. The dolphin language may prove too poor, its final interpretation may not impress our extraterrestrial observers as a feat worth considering as a passport to the galactic confederation.

What other communication problem could be sufficiently difficult to provide such a passport, when solved? Are we confronted with any problem of this type, amounting to a predicament that looms close and vital? Yes, we are.

Aliens with a half-understood language are here. All of a sudden we have become clearly aware of their existence. They are dependent upon us, for their life and for their communication with each other. They are truly alien; though we are mutually interdependent they know nothing about us. We can observe them, we can hope to interpret much of their signal system, it is built on the same fundamental principles we use for the transmission of State secrets and decisions of combat.

Recently the chilling knowledge has dawned upon us that we have been interfering with their signal system and unknowingly we have turned some of them from friends to foes. From now on we can, to some extent, imitate their signals and study the activities released by specific code words. This seems to be very substantial progress, but unless our understanding of the aliens is quick and complete, our mutual interaction will damage our children and all future generations.

Yet they are not enemies. About a purposeful foe the decoder can always ask a meaningful WHY? The aliens have no motives; we can still put the question but we have to search for the answer in a series of interdependent chemical events.

If the aliens could observe us as we observe them, they would have great difficulty in detecting any motives behind our actions. They would hear us make noise and emit some unexpected bursts of quacks and squawks, annoyingly similar to real signals. In spite of breathtaking recent feats of discovery meaningful and safe communication between us and the aliens poses an arduous problem. We have to grapple with it, or bust.

These aliens are our own living cells—living individuals on whom we depend, as a nation depends on individual citizens for its existence. And they are utterly alien, for they live in a universe so different from ours as to be almost totally incomprehensible to us—as ours is incomprehensible to them.

An individual living cell does not know what light is; it cannot see. Light is a packet of violence coming from unimaginable somewhere, and causing change in the cell; if the energy is too intense—ultraviolet light—the cell is destroyed.

Microorganisms are personal, direct enemy-experiences to them, not intellectual abstractions as they are to us. Viruses are subversives, who attack them and cripple or kill personally and directly. Chemical molecules are directly perceived entities—not complicated abstract concepts to be detected only by elaborate laboratory procedures.

And they communicate to each other not in sound-wave and light-wave signals, but by writing messages in those directly perceived chemical molecules.

It was a major feat of Mankind to detect that these minute aliens existed at all—despite the fact that our living is dependent entirely on them.

Now we are seeking to establish communication with them—and it is an horrendous task partly because we have, and can have, *no experiences in common.* They do not see, hear, think, feel, taste, or smell in any manner we mean by those terms. They do not run, jump, walk, or move volitionally, in large part. A muscle cell does not *move;* it stays exactly where it was and contracts.

What living individual cells do experience, we never can experience; what is "normal, everyday activity" to them is something we can't appreciate.

With the dolphin, we have many things in common; we see, we hear—though over a more limited spectrum—we move.

Establishing communication with dolphins should be an enormously simpler task!

Establishing communication with our own living cells, however, is a far more important task. Cancer seems to be the result of a fouled-up message passing among our cells; whether that foul-up results from a chemical carcinogen, a virus, or ionizing radiation makes little difference. We must learn to communicate—for the aliens within us have unguessed secrets of an immensely high-level technology that is, itself, as remote from us as any cultural secrets the star-born aliens might have.

When it comes to microminiaturization of components . . . there's a species of hummingbird that navigates successfully across the Gulf of Mexico. There's a self-guiding navigational computer smaller than a pea in action there.

If we can learn to understand and co-operate with these aliens within us—if we can bridge that gulf of difference of experience—then meeting the aliens from the stars will be not too difficult a problem for us.

In retrospect we understand that the aliens have been with us since the dawn of life. Their existence was disclosed by a series of events that spell a drama of our insatiably curious time.

At two different sessions, in February and March 1865, a learned monk told two score naturalists that he had observed distinct effects of signals, hitherto unknown. He did not use the expression *signal,* he did something worse: He used a crystal-clear mathematical language, entirely new to biologists. No questions were asked and no discussion followed on those occasions. Though some of his hearers were well qualified to judge his results, they and the members of at least one hundred and twenty other learned societies that received the printed account greeted the report with icy silence. Outspoken criticism — the monk had to beg for it—by the foremost contemporary expert shot widely beside the main point: That the signals were discrete, duplicate and constant. A hundred years ago a genial outsider, presenting an entirely new technique in a language borrowed from another field of research, was likely to meet cold expert shoulders.

In 1900 three scientists, working independently of each other, reported the effects of the signals, they also gave credit to their forerunner, the monk, for being the first to observe these distinct effects. A quiet revolution ensued, the effects were studied intensely with the techniques available to the naturalists of the first decade of our century.

Only in 1911 was it established where the signals originated. An American zoologist directed his critical mind to a hypothesis that had been advanced on insufficient grounds. He observed deviations from what was by now establishing itself as a law of nature. He accepted the necessary conclusions, the transmitters are very much among us.

The monk was Gregor Mendel. The zoologist was Thomas Hunt Morgan. What Mendel found by a feat of logical analysis and carefully planned experiments was the factors of inheritance, or genes. These genes occur in pairs in each of our cells, excepting only our mature sex cells. Thus the partner genes segregate when sex cells undergo their final maturity divisions, and they do so independently of other segregating pairs.

Not so, said Morgan, some genes go together. Some fruit flies revealed an unexpected sex distribution in the offspring when certain inherited traits were studied. White eye color, miniature wings and yellow body color are produced by signals emanating from the sex chromosomes, said Morgan at a lecture in Woods Hole, Massachusetts, on July 7, 1911.

Though Morgan had forerunners, his was the fundamental demonstration of a close correspondence between chromosomal behavior and gene seggregation. Genes could be mapped as neighbors on identified chromosomes; first on the X, or sex, chromosomes, then on other chromosomes.

What Morgan observed was exceptions from the laws originally given by Mendel; he interpreted them in the way that remained open to him when his own pet ideas failed, and began to elucidate the material mechanism of the Mendelian laws.

The decade following Morgan's fundamental discovery saw conclusive evidence that the chemical signals, or genes, are carried by the chromosomes. Much of this evidence came from interpretations of the results of chromosomal abnormalities.

Then the stainable substance of the chromosomes, the chromatin, attracted an intense attention. An important part of the chromatin consists of DNA, deoxyribonucleic acid. Observations with the ordinary light microscope, supplemented with experimental crosses, pointed to DNA as a carrier of genetic information. In 1953 Watson and Crick revealed the intimate structure of the DNA molecule. It is a long, double-coiled molecule with a structure that was immediately recognized as a credible information carrier. The great progress that followed would not have been possible without the previous developments of Information Theory, which was as important to understanding the mechanism as was the chemical and biological research itself.

Could this long molecule transmit chemical signals from cell generation to cell generation, without change? The answer seemed to be affirmative. The DNA molecule has the general build of a twisted rope ladder, the rungs consist of base pairs and the strands of sugar-phosphate compounds. Now the bases are paired in a fixed way, so that thymine fixed to one strand always bridges with adenine on the other; guanine builds a rung with cytosine only. This would mean that a single strand of DNA would have the potentiality of exact replication by base pairing.

Soon chemical evidence of the exact replication of the DNA molecule made it a likely carrier of genetic information, not only from cell generation to cell generation, but from one generation of individuals to another, through millions of years, without change. But how was this information laid down? What primary meaning did it carry? It was not enough to know that some system of signals, some array of dots and dashes, could be repeated eternally. The signals did something.

Such visible results of the signal pattern as the formation of the coloring matter of blood and a normal palate were well known. When a signal went wrong a blood disease developed or a cleft palate was observed. The question what the signals did had to do with the hidden causes of visible abnormalities and the primary regulators of normal growth and formaiton.

Then the amino acids demand consideration. They are the building stones of proteins that serve all vital processes, including formative processes during fetal life. Proteins can be broken down into chains of amino acids. It would be logical to suspect that the chemical signals determine what amino acids shall build up a given polypeptide chain.

If so, could base pairs constitute the specific signals for the incorporation of amino acids? Let us see what this suggestion would imply. A A could be one pair (adenine - adenine), A C (adenine - cytosine) another. The pairs we are speaking of now are arranged along one strand of the rope ladder molecule, they are not the pairs constituting the rungs. Well, we could get sixteen pairs from our four different bases. But we are soon confronted with a logical fact: the amino acids we have to provide signals for are twenty in number.

On the other hand base triplets, such as A A C and A A A, would supply us with sixty-four distinct signals. We need only twenty. This could, theoretically, mean that the incorporation of one specific amino acid on one specific site in a polypeptide chain could be brought about by more than one triplet.

To bring home a message through noise we can repeat the message and risk that it be distorted in the same way repeatedly. We can bring in redundancy and feel much safer: JUMP. BAIL OUT. SCRAM. In a code redundancy can be attained by making the code degenerate, i.e. using several elements with an identical meaning. A triplet code with a certain amount of degeneracy would be acceptable as a means of bringing home the genetic messages with precision and safety.

Theoretically we could read any three-letter code in different ways. Suppose we happen to intercept the following part of a cryptic message:

G C C A T A G C G

We could read it: G C C, A T A, G C G, or alternatively: G C C, C C A, C A T; or even: G C C, C A T, T A G. The code could, in other words, be more or less overlapping.

As an overlapping code would convey important biologic implications we may well ask ourselves if such a possibility could be proved or excluded. In general, intercepted messages can prove that a certain code is non-overlapping if its triplets have too many different companions.

If we know that the four letters G, C, A and T are the only code elements, and if each triplet shares two letters with the succeeding triplet, then we can conclude that only four different triplets can precede any given triplet. It can be succeeded by the same maximum number of triplets. This is why any additional number of accompanying triplets contradict an overlapping code.

What if no intercepted messages are available for analysis? Can we still arrive at reasonably safe conclusions about the construction of the code? The rather obvious approach in such instances departs from a known text that has been encoded in the incompletely known system. Can that code system be a set of overlapping triplets of four elements? To answer this question we tabulate all triplets in the known text. The next step is demonstrated by Table I, where the letter *a* is the center of thirty-three different triplets.

Table 1

NEIGHBORS OF LETTER A

TRIPLET	NEIGHBOR *left*	NEIGHBOR *right*	TRIPLET	NEIGHBOR *left*	NEIGHBOR *right*
bal	b	l	man	m	n
ban	b	n	mar	m	r
cal	c	l	mat	m	t
car	c	r	may	m	y
cas	c	s	nal	n	l
dab	d	b	nat	n	t
eac	e	c	oad	o	d
ear	e	r	ran	r	n
eas	e	s	rat	r	t
fac	f	c	sam	s	m
hal	h	l	san	s	n
han	h	n	tat	t	t
has	h	s	uad	u	d
hat	h	t	ual	u	l
hav	h	v	uan	u	n
lan	l	n	wav	w	v
lat	l	t			
TOTAL OF DIFFERENT NEIGHBORS				15	11

When we count the different left neighbors of *a* they reduce to fifteen, the right neighbors are only eleven. Now we have to assign one triplet to four different right (or left) neighbors or part thereof. Thus the actually observed fifteen left neighbors of *a* require a minimum number of four triplets.

Proceeding in the same way we count the neighbors of *b*, *c* . . . and continue until one of two results has been attained. If the minimum number of required triplets accumulates to more than sixty-four, we can stop counting and be convinced that this message has not been sent by an overlapping code with the specified restrictions. If we have tabulated all available triplets centering *a* through *z* and the number of required triplets totals sixty-four or less, we have to keep open the possibility that the code used for transmitting this message is overlapping. Of course the text can be too brief to admit any definite conclusion.

This approach through a message known to have been transmitted in the practically unknown code language was tried by Brenner in 1957. The letters and words of the known text consisted of amino acids and sequences of amino acids. A total of seventy code triplets was required to represent the sequences known at the time. Thus an adequate use of fairly incomplete knowledge led to the important conclusion that the unknown code could not use overlapping triplets.

Then it could be predicted that the substitution of a single triplet in the DNA molecule would result in a corresponding substitution of one single amino acid in a polypeptide chain, not in the supplanting of two or three adjacent amino acids. Recently exact techniques have verified this prediction.

The very first evidence for a specific replacement of one single amino acid by a mutation was presented by Ingram in 1957. He let amino acids

continued on page 81

DUNE WORLD

First of Three Parts. Herbert's last great novel was a tale of men Under Pressure of war and deep water. This is a story of men under pressure of politics and the dehydration of a waterless world . . . **BY FRANK HERBERT**

Illustrated by John Schoenherr

A beginning is the time for taking the most delicate care that the balances are correct. This, every sister of the Bene Gesserit knows. To begin your study of the life of Muad'Dib, then, take care that you first place him in his time: born in the fifty-seventh year of the Padishah Emperor, Shaddam IV. And take the most special care that you locate Muad'Dib in his place: the planet Arrakis. Do not be deceived by the fact that he was born on Caladan and lived his first fifteen years there. Arrakis, the planet known as Dune, is forever his place.

"Manual of Maud'Dib"
by The Princess Irulan

In the week before their departure to Arrakis, when all the final scurrying about had reached a near unbearable frenzy, an old crone of a woman came to visit the mother of the boy, Paul.

It was a warm night at Castle Caladan, and the ancient pile of stone that had served the Atreides family as home for twenty-six generations bore that cooled-sweat feeling it acquired before a change in the weather.

The old woman was let in by the side door down the vaulted passage next to Paul's room, and she was allowed a moment to peer in at him where he lay in his bed.

By the half-light of a suspensor lamp, dimmed and hanging near the floor, the awakened boy could see a bulky female shape at his door, standing one step ahead of his mother. The old woman was a witch shadow—hair like matted spiderwebs, hooded 'round darkness of features, eyes like glittering jewels.

"It he not small for his age, Jessica?" the old woman asked. Her voice wheezed like an untuned baliset.

Paul's mother answered in her soft contralto: "The Atreides are known to start late getting their growth, Your Reverence."

"So I've heard . . . so I've heard," wheezed the old woman. "Yet he's already fifteen."

"Yes, Your Reverence."

"He's awake and listening to us," said the old woman. "Sly little rascal you've born here, Jessica." She chuckled. "But royalty has need of slyness. And if he's really the *Kwisatz Haderach* . . . well, slyness will be most valuable."

Within the shadows of his bed, Paul held his eyes opened to mere slits. Two bird-bright ovals—the eyes of the old woman—seemed to expand and glow as they stared into his.

"Sleep well, you sly little rascal," said the old woman. "Tomorrow you'll need all your faculties to meet my *gom jabbar.*"

And she was gone, pushing his mother out, closing the door with a solid thump.

Paul lay awake, wondering at such strangeness. *What's a gom jabbar?* he wondered.

In all the upset during this time of change, the old woman was the strangest thing he had seen.

Your Reverence.

And the way she called his mother Jessica like a common serving wench instead of what she was—a Bene Gesserit Lady, a duke's concubine and mother of the ducal heir.

Is a gom jabbar something of Arrakis I should know before we go there? he wondered.

He mouthed her strange words: *Gom jabbar . . . Kwisatz Haderach.*

There had been so many things to learn. Arrakis would be a place so different from Caladan that Paul's mind whirled with the differences. *Arrakis—Dune—Desert Planet.* It was the sole source in the universe for the geriatric spice, *melange.* But their move to Arrakis was linked somehow to the long feud between the Houses of Atreides and Harkonnen.

Thufir Hawat, his father's Master of Assassins, had explained it: Harkonnens had been on Arrakis eighty years, holding the planet in quasi-fief under a CHOAM Company contract to mine the spice. Now, the Harkonnens were leaving to be replaced by the House of Atreides in fief-complete—an apparent victory for the Duke Leto. Yet, Hawat said this appearance contained the deadliest peril, for the Duke Leto was popular among the Great Houses of the Landsraad.

"A popular man arouses the jealousy of the powerful," Hawat said.

Arrakis—Dune—Desert Planet.

Paul fell asleep to dream of an Arrakeen cavern, silent people all around him moving in the dim light of glowtubes. It was solemn there and like a cathedral as he listened to a faint sound—the *drip-drip-drip* of water. Even while he remained in the dream Paul knew he would remember it upon awakening. He always remembered the important dreams.

The dream faded. Paul half awoke to feel himself in the warmth of his bed . . . thinking . . . thinking. This world of Castle Caladan—without play or companions his own age—perhaps it did not deserve sadness in farewell. Dr. Yueh, his teacher, had hinted at exciting things on Arrakis—even the *faufreluches,* the system of class distinction, was not as rigidly guarded there. Arrakis sheltered people who lived at the desert edge without *caid* or *bashar* to command them: will-o-the-sand people called Fremen, marked down on no census of the Imperial Regate.

Arrakis—Dune—Desert Planet.

Paul sensed his own tensions, knew he'd not sleep more this night. He decided to practice one of the Bene Gesserit mind/body lessons his mother had taught him. Three quick breaths triggered the necessary responses. He fell into the floating awareness . . . focusing the consciousness . . . aortal dilation . . . avoiding the unfocused mechanism of consciousness . . . to be conscious by choice . . . blood enriched and swift-flooding the overload regions . . . *one does not obtain food, safety or freedom by instinct . . . animal consciousness does not extend beyond the given* *moment nor into the idea that its victims may become extinct . . . the animal destroys and does not produce . . . animal pleasures remain close to sensation levels and avoid the perceptual . . . true-human requires a background grid through which to see his universe . . . focused consciousness-by-choice forms that grid . . . bodily integrity comes through nerve/blood flow according to deep awareness of cell needs . . . all things/cells/beings are impermanent . . . strive for the flow-permanence within . . .*

Over and over within Paul's floating awareness the lesson rolled, and at its hub lay the single conceptualization:

The human can assess his circumstances and judge his limitations of the moment by a process of mental programming, never risking flesh until the optimum course is computed. The human does this within a compression of real time so short that it may be called instantaneous.

In time, dawn touched Paul's windowsill with yellow light. He sensed it through closed eyelids, opened them, hearing then the renewed bustle and hurry in the castle, seeing the familiar patterned beams of his bedroom ceiling.

The hall door opened and his mother peered in, her bronze shade of hair held with black ribbon at the crown, the oval face emotionless and green eyes staring solemnly.

"You're awake," she said. "Did you sleep well?"

"Yes."

He studied the tallness of her as she entered, saw the hint of tension in her shoulders as she chose clothing for him from the closet racks. Another might have missed the tension, but she had trained him in the Bene Gesserit Way—in the minutae of observation. She turned, holding a semiformal jacket for him to wear. It carried the red Atreides hawk crest above the breast pocket.

"Hurry and get dressed," she said. "The Reverend Mother is waiting."

The Reverend Mother Gaius Helen Mohiam sat in a tapestried chair watching mother and son approach. On each side of her, windows overlooked the curving southern bend of the river and the green farmlands of the Atreides Family Holding, but the Reverend Mother ignored the view. She was feeling her age this morning, more than a little petulant. She blamed it on space travel and association with that abominable Spacing Guild and its secretive ways. But here was a mission that required personal attention from a Bene-Gesserit-With-The-Sight. Even the Padishah Emperor's Truthsayer couldn't evade that responsibility when the Duty call came.

That Jessica! the Reverend Mother thought. *If only she'd born us a girl as she was ordered to do!*

Jessica stopped three paces from the chair, dropped a small curtsy with a gentle flick of left hand along the line of her skirt. Paul gave the short bow his dancing master had taught—the one used "when in doubt of another's station."

The nuances of Paul's greeting were not lost on the Reverend Mother. She said: "He's a cautious one, Jessica."

Jessica's hand went to Paul's shoulder, tightened there. For a heartbeat, fear pulsed through her palm. Then she had herself under control. "Thus he has been taught, Your Reverence."

And again, Paul wondered: *What does she fear?*

The old woman studied Paul in one gestalten flicker: face oval like Jessica's, but strong bones . . . hair—the Duke's black-black, and that thin, disdainful nose; shape of directly staring green eyes . . . like the Old Duke, the grandfather who is dead.

Now, there was a man who appreciated the power of bravura—even in death, the Reverend Mother thought.

"Teaching is one thing," she said, "the basic ingredient is another. We shall see." The old eyes darted a hard glance at Jessica. "Leave us. I enjoin you to practice the Meditation of Peace."

Jessica took her hand from Paul's shoulder. "Your Reverence I . . ."

"You know it must be done, Jessica."

Paul looked up at his mother, puzzled by this solemnity.

Jessica straightened. "Yes, of course."

Paul looked back at the Reverend Mother. Politeness and his mother's obvious awe of this old woman argued caution. Yet, he didn't care for the fear he felt radiating from his mother.

"Paul . . ." Jessica took a quieting breathing. "Paul, this . . . *test* you're about to get . . . it's important to me."

"Test?" He looked up at her.

"Remember that you're a Duke's son," Jessica said. She whirled and strode from the room in a dry swishing of skirt. The door closed solidly behind her.

Paul faced the old woman, holding his anger in check. "Does one dismiss the Lady Jessica as though she were a serving wench?"

A smile flickered at the corners of the wrinkled old mouth. "The Lady Jessica *was* my serving wench, lad, for fourteen years at school." She nodded. "And a good one, too. Now, *you* come here!"

The command whipped out at him, and Paul found himself obeying before he could think about it. *Using the Voice on me,* he thought. *I should've expected it.*

At a gesture, he stopped beside the old woman's knees.

"See this?" she asked. From the folds of her gown, she lifted a green metal cube about fifteen centimeters on a side. She turned it and Paul saw that one side of the cube was open—black and oddly frightening. No light penetrated that open end.

"Put your right hand in the box," the old woman said. She moved the box.

Fear shot through Paul. He started to back away, but the old woman said: "Is this how you obey your mother?"

He looked up into bird-bright eyes.

"She told you it was important," the Reverend Mother said.

Slowly, feeling the compulsions and unable to inhibit them, Paul put his hand in the box. He felt first a sense of cold as the blackness closed around his hand, then slick metal against his fingers and a prickling as though his hand were asleep.

A predatory look filled the old woman's features. She lifted her right hand away from the box and poised the hand close to the side of Paul's neck. He saw a glint of metal there and started to turn toward it.

"Stop!" she snapped.

Using the Voice again! He swung his attention back to her face.

"I hold at your neck the *gom jabbar*," said the old woman." "The *gom jabbar*, the high-handed enemy. It is a needle with a drop of poison on its tip. Ah-ah! Don't pull away or you'll feel the poison!"

Paul tried to swallow in a dry throat. He could not take his attention from that seamed old face, the glistening eyes, the pale gums around silvery metal teeth that flashed as she spoke.

"A Duke's son *must* know about poisons," she said. "It's the way of our times, eh? *Musky*, to be poisoned in your drink. *Aumas*, to be poisoned in your food. The quick ones and the slow ones and the ones in between. Well, lad, here's a new one: the *gom jabbar*. It kills only animals."

Pride overcame Paul's fear and he said: "You dare suggest a Duke's son is an animal?"

"Let us say I suggest you may be human," she said. "Steady! I warn you not to try jerking away. I may be old, but my hand can drive this needle into your neck before you escape me."

"Who are you?" he whispered. "How did you trick my mother into leaving me alone with you? Are you from the Harkonnens?"

"The Harkonnens? Bless us, no! Not the Harkonnens. Now, be silent." A dry finger touched his neck and he stilled the involuntary urge to leap back.

"Good lad," she said. "You pass the first test. Now, here's the way of the rest of it: If you withdraw your hand from the box, you die. That's the only rule of the test. Keep your hand in the box and you'll live. Withdraw it and die."

Paul took a deep breath to still his trembling. "If I call out, there'll be servants on you within seconds and *you'll* die."

"The servants will not pass your mother who stands guard at that door. Depend on it. Your mother survived this test. Now, it's your turn. Be honored; we seldom administer it to men-children."

Curiosity brought Paul's fear and anger into manageable limits. If his mother really stood guard out there . . . He heard truth in the old woman's voice. And if this were a test . . . whatever it was, he knew he was caught in it, trapped by that hand at his neck: *gom jabbar*. He recalled the response from the Litany of Fear as his mother had taught it to him out of the Bene Gesserit rite:

"I must not fear. Fear is the mind-killer. Fear is the little-death that brings total obliteration. I will face my fear. I will permit it to pass over me and through me. And when it has gone past I will turn the inner eye to see its path. Where the fear has gone there will be nothing. Only I will remain."

He felt calmness flow over him, said: "Get on with your test, old woman."

"Old woman, yet!" she snapped. "You've courage, and that can't be denied. Well! We shall see, sirra. Now . . ." She bent close to him, lowered her voice almost to a whisper. "You will feel pain in this hand within the box. Pain. But! If you withdraw the hand, I'll touch your neck with my *gom jabbar*—the death so swift it'll be like the fall of the headsman's axe. Withdraw your hand from the box and the *gom jabbar* takes you. Do you undersand?"

"What's in the box?"

"Pain."

He felt the tingling in his hand increase, and he pressed his lips tightly together. *How could this be a test?* he wondered. The tingling became an itch.

The old woman said: "You've heard of animals chewing off a leg to escape a trap? That's an animal kind of trick. A human would remain in the trap, enduring the pain, feigning death that he might kill the trapper and remove a threat to his kind."

The itch in his hand became the faintest burning. "Why are you doing this?" he demanded.

"To determine if you're human. Be silent."

Paul clenched his left hand into a fist as the burning sensation increased in the other hand. It mounted slowly . . . heat . . . upon heat . . . upon heat. He felt the fingernails of his free hand biting the palm and tried to flex the burning hand, but couldn't move the fingers.

"It burns," he whispered.

"Silence!"

Pain messages throbbed up his arm. Sweat stood out on his forehead. Every fiber cried out to withdraw the hand from that burning pit . . . but . . . the *gom jabbar*. Without turning his head, he tried to move his eyes to see that terrible needle poised beside his neck. He sensed that he was breathing in gasps, tried to slow his breaths and couldn't.

Pain!

The world emptied of everything except the hand immersed in agony, and the ancient face inches away staring at him.

His lips were so dry he had difficulty separating them. The burning! The burning! The burning! He thought he could feel skin curling black on that agonizing hand, the flesh crisping and dropping away until only charred bones remained.

It stopped!

As though a switch had been turned off, the pain stopped.

Paul felt his arm trembling, felt sweat bathing his body.

"Enough!" the old woman muttered. "*Kull wahad!*" She shook her head. "I must've wanted you to fail. No womanchild ever withstood that much." She leaned back, withdrawing her hand and its needle from the side of his neck. "Take your hand from the box, young human, and look at it."

He fought down an aching shiver, stared at the lightless void where his hand seemed to remain of its own volition. Memory of pain inhibited every movement. Reason told him he would withdraw a blackened stump from that box.

"Do it!" she snapped.

He jerked his hand from the box, stared at it astonished. Not a mark. Not a sign of pain upon that flesh. He held the hand up in front of his eyes, turned it, flexed the fingers. Unmarked.

"Simple nerve induction did it," the old woman said. "Can't go around maiming potential humans. There're those who'd give a pretty for the secret of this box, though." She slipped it back into the folds of her gown.

"But the pain . . ." he said.

"Pain," she sniffed. "A human can override any nerve in the body."

Paul felt his left hand aching, felt it still clenched into a fist. He uncurled the fingers, looked at four bloody marks in his palm where fingernails had bitten flesh. He dropped the hand to his side, looked at the old woman. "You did that to my mother once?"

"Did you ever sift sand through a screen?" she asked.

The tangential slash of her question shocked his mind into higher awareness. "Sift . . . I've seen the workmen do it at our ocean beach, but . . ."

"We sift people. Everything in Bene Gesserit is to sift people, finding the humans among us."

He lifted his right hand, willing the memory of the pain into his consciousness. "Pain . . . that's all there is to it?"

"I *observed* you in pain, lad. Pain's merely the axis, the point upon which the test turns. Your mother's told you about our ways of observing. I see the signs of her teaching in you. This test is crisis and observation."

He heard truth in her voice, said: "It's truth."

The Reverend Mother stared at him. *He senses truth! Could he be the one? Could he truly be the one?* She extinguished the excitement, reminding herself: "*Hope clouds observation.*"

"You know when people believe what they say," she said. "You know truth."

"Yes."

The harmonics of belief confirmed by repeated test were in his voice. She heard them, said: "Perhaps you are the *Kwisatz Haderach*. Sit down, little brother, here at my feet."

"I prefer to stand."

"Your mother sat at my feet; why shouldn't you?"

"I'm not my mother."

"You hate us a little, eh?" She looked toward the door, called out: "Jessica!"

The door flew open and Jessica stood there, staring hard-eyed into the room. The hardness melted from her as she saw Paul. She managed a faint smile.

"Jessica, have you ever stopped hating me?" the old woman asked.

"I both hate and love you," Jessica said. "The hate—that's from pains I must never forget. The love—that's . . ."

"Just the basic fact," the old woman said, but her voice was gentle. "You may come in now, but remain silent. Close the door and mind it that no one interrupts."

Jessica stepped into the room, closed the door and stood with her back to it. *My son lives,* she thought. *My son lives and is human. I knew he was . . . but . . . he lives. Now. I can go on living.* The door felt hard and real against her back. Everything in the room was immediate and pressing against her senses.

My son lives.

Paul looked at his mother, saw her press her head against the door. *She told the truth.* He wanted to get away alone and think about this situation, but knew he could not leave until dismissed. The old woman had gained a power over him. *They spoke truth.* His mother had undergone this test. There must be terrible purpose in it . . . the pain and fear had been terrible. Terrible purposes he understood. They drove against all odds. They were their own necessity. Paul felt that he had been infected with Terrible Purpose. He did not knew yet what the Terrible Purpose was.

"Some day, lad," the old woman said, "you, too, may have to wait outside a door like that one. It takes a measure of doing."

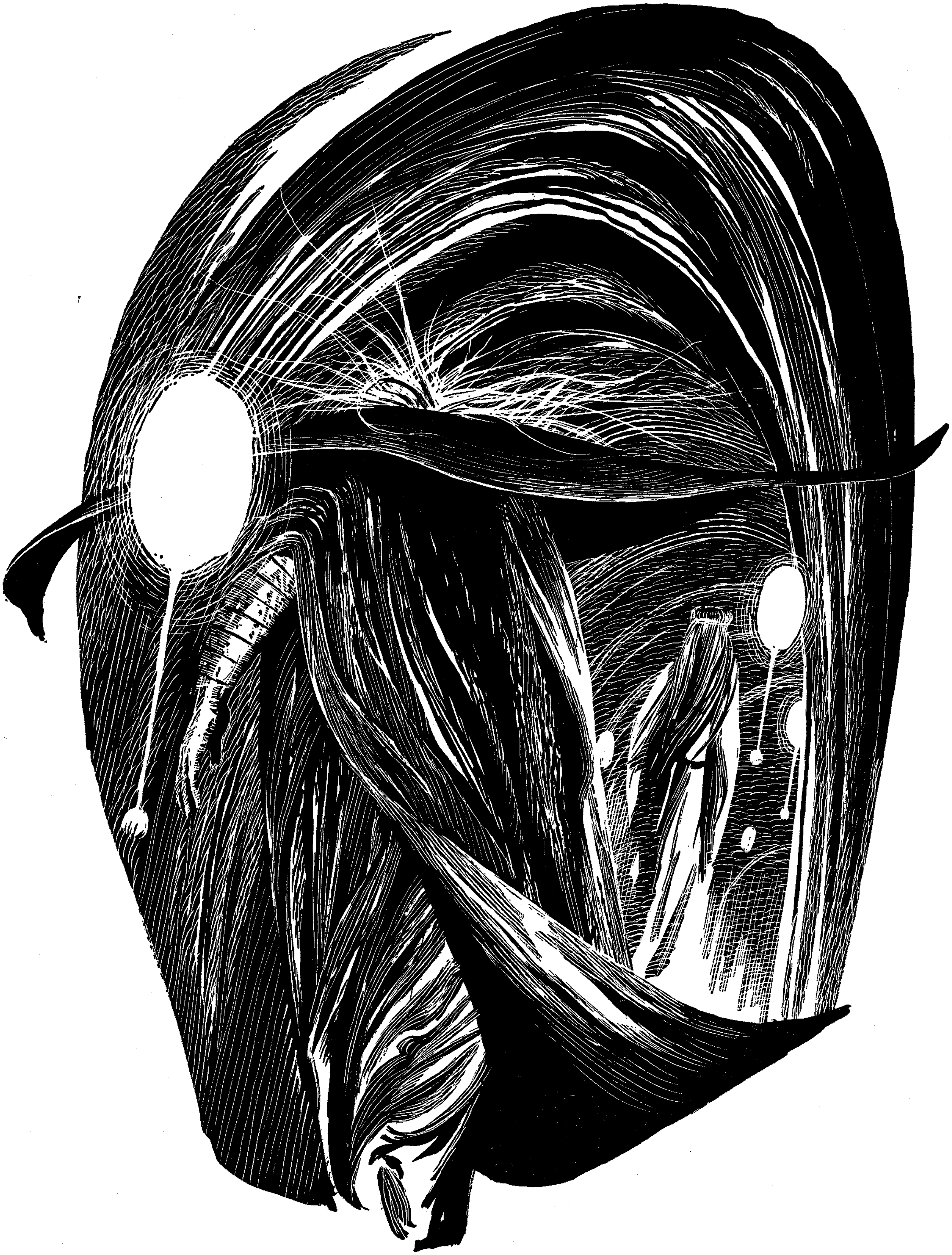
Paul looked down at the hand that had known pain, then up to the Reverend Mother. The sound of her voice just then had contained a difference from any other voice in his experience. The words were outlined in brilliance. There was an edge to them. He felt that any question he might ask her would bring an answer that could lift him out of his flesh-world into something greater.

"So I'm human," he said. "Why do you test for this?"

"Long ago," the old woman said, "long before the shield belt even, men turned their minds over to machines in the hope this would set them free. But that only permitted other men with machines to enslave them. What do you say to this?"

"Thou shalt not make a machine in the likeness of a man's mind," Paul quoted.

"Right out of the Orange Catholic Bible," she said. "What the OC Bible should've said, though, is this: 'Thou shalt not make a machine to counterfeit a *human* mind.' You have a Mentat in your service. Have you studied him?"



"Thufir Hawat, my father's Master of Assassins. I've studied *with* him."

"A human is still the finest computer," she said, "the smallest for its variability, portable and self-propelled, self-programming, capable of performing more tasks simultaneously, cheapest to maintain because it maintains itself . . . I could go on at much greater length. Have you studied also about the Butlerian Jihad, the Great Revolt?"

"I know why we destroyed the machines that think," he said. He could not keep the sullen tone out of his voice, wondering: *Why these juvenile questions?*

The Reverend Mother ignored his tone, said: "The Great Revolt took away a crutch, forced *human* minds to develop. Almost immediately afterward, schools were started to train these *human* talents."

"Bene Gesserit schools?"

She nodded. "The two chief survivors of those ancient schools are the Bene Gesserit and the Spacing Guild. The Guild emphasizes almost pure mathematics, so we believe. Bene Gesserit performs another function."

Paul realized that she was forcing him to answer his own question about Bene Gesserit, that he was supposed to answer now, that this was still part of the test. She wanted him to summate her clues and name the function of Bene Gesserit's seeking after humans.

"Politics," he said.

"Kull wahad!" the old woman breathed. She sent a hard glance at Jessica.

"I've not told him, Your Reverence," Jessica said.

The Reverend Mother nodded, returned her attention to Paul. "You did that on very few clues," she said. "Yes, politics. The original Bene Gesserit school was directed by a human who saw the need for a thread of continuity in *human* affairs. She saw there could be no such continuity without separating human stock from animal stock . . . for breeding purposes."

The old woman's words had abruptly lost their special sharpness for Paul. He felt an offense against what his mother called his *instinct for rightness.* It wasn't that the Reverend Mother lied to him . . . she obviously believed what she said. It was something deeper.

"So you concentrated on women," Paul said. "But my mother tells me many Bene Gesserits of the Schools don't know their mothers."

"But your mother's genetic line is in our records," the old woman said. "She knows that either her mother was Bene Gesserit or her stock was acceptable in itself."

"Why couldn't she know her parentage then?"

"Many reasons. We might, for example, have wanted to breed her to a close relative to set up a dominant in some genetic trait. We have many reasons."

Again, Paul felt that *offense against rightness.* "It sounds as though you take responsibility for many lives," he said.

The Reverend Mother looker at him sharply. *Did I hear criticism in his voice?* "We carry a heavy burden," she said.

Paul leveled a measuring stare at her, said: "You say maybe I'm the . . . *Kwisatz Haderach.* What's that, a human, *gom jabbar?"*

"I'd prefer a different tone from you, young human," she said. "But I understand your resentment."

"Paul . . ." Jessica said.

"I'll handle this, Jessica," the old woman said. "Now, Paul, do you know of the Truthsayer drug?"

"My mother's told me."

"So. When I am gifted by the drug I can look down many avenues of my past . . . but only the feminine avenues. There's a place where no Truthsayer can see. We are repelled and terrorized by it." Her voice took on a tone of sadness. "We are women and we cannot see. Yet, it is said a man will come some day and find in the gift of the drug an inward eye to scan all of his past—both feminine and masculine. This is the *Kwisatz Haderach,* the one who can be many places at once. Many men have tried . . . so many, but none has succeeded.

"They tried and failed, all of them?"

"Oh, no." She shook her head. "They tried and died."

II

To attempt an understanding of Muad'Dib without understanding his mortal enemies, the Harkonnens, is to attempt seeing Truth without knowing Falsehood. It is the attempt to see the Light without knowing Darkness. It cannot be.

"Manual of Muad'Dib"
by The Princess Irulan

It was a relief globe of a world, partly in shadows, spinning under the impetus of a fat hand that glittered with rings. The globe sat on a freedom stand at one wall of a windowless room whose other walls were filled with scrolls, books, tapes and film reels. Light glowed from golden balls hanging in mobile suspensor fields. An ellipsoid desk with top of jade pink petrified *elacca* wood stood at the center of the room. Veriform suspensor chairs were distributed casually around the desk. Two of the chairs were occupied—in one a dark haired youth of about sixteen years, round of face and with sullen eyes; in the other a slender, short man with effeminate face.

The round-faced youth wore a plain black leotard of velvet. His lips, full and pouting, were a Harkonnen genetic marker.

It was always the eyes of the effeminate-faced man that non-Arrakeen people noticed first. The eyes were shaded slits of blue within blue—no white in them at all.

Both youth and blue-eyed man stared across the room at the globe and the man in the shadows spinning it.

A chuckle sounded beside the globe, and a basso voice rumbled out of the chuckle: "There it is, Piter—the biggest mantrap in all history. And the Duke's already headed into its jaws. Is it not a magnificent thing the Baron Vladimir Harkonnen does?"

"Assuredly, Baron," said the effeminate-faced man. His voice came out tenor with a sweet, musical quality.

The fat hand came down onto the globe, stopping the spin. Now the eyes in the room could focus on that motionless surface and see that it was the kind of globe made for wealthy collectors or planetary governors of the Empire. Latitude and longitude lines were laid in with hair-fine silver wire. Its polar caps were insets of milk diamonds.

Again, the fat hand moved, tracing details on the globe's surface. As the hand moved, the basso voice rumbled: "I invite you to observe, Piter, and you, too, Feyd-Rautha, my darling. From sixty degrees north to about seventy degrees south — these exquisite ripples. Their coloring. Does it not remind you of sweet caramels? And observe—nowhere do you see the blue of lakes, rivers or seas. And these polar caps—so small. Could anyone mistake this place? Arrakis is unique. Truly unique. What a superb setting for a unique victory!"

A smile touched Piter's effeminate face. "And to think, Baron: the Padishah Emperor believes he's given the Duke your spice planet. How poignant."

"The Padishah Emperor knows what he's about," the Baron growled. "He thinks of the CHOAM Company."

The sullen-faced youth stirred in his chair, straightened a wrinkle in his leotards. "But you're in the CHOAM Company, uncle."

"Feyd! I told you to listen and learn when I invited you in here," the Baron said. "But I'll tell you that CHOAM Company profits bother me when they involve the spice. *All* the profits from melange should go into the Harkonnen coffers. We're the ones broke that planet to harness."

And the Baron fell silent, thinking: *Indeed, yes; we tamed Arrakis. Except for the few mongrels Fremen hiding in the skirts of the desert . . . and some tame smugglers bound to the planet almost as tightly as the native labor pool. What could smugglers do except trade a trickle of spice to an occasional Spacing Guild freighter, or carry a few spies and assassins on and off the planet?*

A discreet tapping sounded at the door in the far wall. Piter unfolded from his chair, crossed the room, cracked the door and accepted a message cylinder. He closed the door, unrolled the cylinder and scanned its surface. Piter chuckled, turned to the Baron still standing in shadows beside the globe.

"The fool answered us, Baron. The fool answered!"

"When ever did an Atreides refuse the opportunity for a gesture?" the Baron asked. "Well, what does he say?"

"Baron, he's most uncouth. He addresses you as 'Harkonnen'—no 'Sire et Cher Cousin', no title, no nothing."

"It's a good name," the Baron growled, and his voice betrayed his impatience. "What does dear Leto say?"

"He says: 'Your offer of a meeting is refused. I have oft times met your treachery and this all men know.' "

"How complimentary!" the Baron said. "Do go on."

"He says: 'The art of *Kenly* still has admirers in the Empire.' And he signs it: 'Duke Leto of Arrakis.' " Piter began to laugh loudly. "Of Arrakis! Oh, my! This is almost too rich!"

"Be quiet, Piter," the Baron said, and the laughter stopped as though shut off with a switch. "*Kenly*, is it?" the Baron said. "Vendetta, heh? And he uses the nice old word so rich in tradition to be sure I know he means it."

"But, Baron," Piter said, "his message is in our hands. You have but to show this before the Landsraad, and it justifies anything. Simply anything. You made the peace gesture and were refused."

"For a Mentat, you talk too much, Piter," the Baron said. And he thought: *I must do away with that one soon. He has almost outlived his usefulness.* The Baron stared across the room at Piter's blue eyes—the dark pits without whites. *And those eyes! There's no guessing what such a one thinks.*

A grin flashed across Piter's face, and it was like a mask grimace beneath those eyes-like-holes. "But, Baron, never has revenge been more beautiful. It is to see a plan of the most exquisite treachery; to *make* Leto exchange Caladan for Dune—and without alternative because it's the Padishah Emperor's command. How waggish of you!"

In a cold voice, the Baron said: "You have a flux of the mouth, Piter."

"But I am happy. Whereas you are touched by jealousy."

"Piter!"

"Ah, ah, Baron! Is it not regrettable that you were unable to devise this wonderful scheme by yourself?"

"Someday I will have you strangled, Piter."

"Of a certainty, Baron. *Enfin!* But a kind act is never lost, true?"

"Have you been chewing *verite* or *semuta*, Piter?"

"Truth without fear surprises the Baron?" Piter's face became a caricature of a frowning mask. "Ah, hah! But you see, Baron, I know as a Mentat when you will send the executioner. You will refrain just so long as I am useful. To move sooner would be a horrible waste and I am yet of much use to you. I know what it is you learned from that lovely little Dune planet—waste not. True, Baron?"

The Baron continued to stare at Piter thoughtfully.

Feyd-Rautha squirmed in his chair. *These wrangling fools!* he thought. *My uncle cannot talk to a man without arguing. I wish they'd hurry and get through whatever it is they're up to. Do they think I've nothing to do except listen to arguments?*

"Sometimes I wonder about you, Piter," the Baron said. "I cause pain out of necessity, but you . . . I swear you take a positive pleasure in it. For myself, I can feel pity toward the poor Duke Leto. Dr. Yueh will move against him soon, and it'll all be over for the Duke. But, surely, he'll know whose hand directed the pliant doctor . . . and that knowing will be a terrible thing, Piter."

"Then why haven't you directed the doctor to slip a knife into him quietly and efficiently?" Piter demanded. "You talk of pity . . . you—"

"It must be done this way," the Baron said. "The Duke must know when I encompass his doom . . . and the other Great Houses must learn the extent of my revenge. It'll give them pause. It'll give me a bit more room in which to maneuver. The necessity is obvious, but I don't have to like it."

"Room to maneuver," Piter sneered. "Already you have the Padishah Emperor's eyes on you, Baron. You move too boldly. One of these days the Padishah Emperor will send a legion or two of his Sardaukar down here onto Giedi Prime and that'll be an end to the Baron Vladimir Harkonnen."

"You'd like to see that, wouldn't you, Piter?" the Baron asked. "You'd enjoy seeing the Corps of Sardauker pillage through my cities the way they do, and sack this castle? You'd truly enjoy that."

"Does the Baron need to ask?" Piter whispered.

"You should've been a Beshar of the Corps," the Baron said, "the way you enjoy blood. Your interest is the blood and the pain. Yes." The Baron nodded. "What is it I promised you of Arrakis?"

Piter's dark eyes narrowed to slits. "Do you toy with Piter, Baron?"

"Was it the Lady Jessica to do with as you wished?" the Baron asked.

Piter took five curiously mincing steps into the room stopped directly behind Feyd-Rautha. There was a tight air of tension in the room, and the youth in the chair looked up at Piter with a worried frown.

"Do not toy with Piter, Baron," Piter said. "You know you promised her to me."

"For what, Piter?" the Baron asked. "For pain?"

Piter stared at him, dragging out the silence.

Feyd-Rautha moved his suspensor chair to one side, said: "Uncle, why'm I here? You said you'd something important to—"

"My darling Feyd-Rautha grows impatient," the Baron said. The Baron moved within the shadows besides the globe. "I caution you to patience, Feyd." And he turned his attention back to Piter. "What of the Dukeling the child called Paul, my dear Piter?"

"Our plan will bring him to you, Baron," Piter muttered, "and the loss will go unnoticed in the shadow of the father's falling."

"From his pictures I know that lad to have a sweet young body," the Baron murmured. "I'm sure of it. And I would say he's potentially more dangerous than the father . . . with that mother to train him. Accursed woman!" He stared hard at Piter. "'You'll recall, Piter, that you predicted the woman would bear a daughter to the Duke. You were wrong, eh, Mentat?"

"I'm not often wrong, Baron," Piter said, and for the first time there was an edge of fear in his voice. "Give me that: I'm not often wrong. And you know yourself these Bene Gesserits bear mostly daughters. Even the Padishah Emperor's consort has produced only females."

"Uncle," said Feyd-Rautha, "what's the *important* thing you said I must learn here? You said I'—"

"Listen to my nephew," the Baron said. "He aspires to rule my Barony someday, yet he cannot rule himself." The Baron stirred beside the globe, a shadow among shadows. "Well, then, young Feyd-Rautha Harkonnen, I summoned you here hoping to teach you wisdom. Have you observed Piter? You should've learned something from him."

"But—"

"A most efficient Mentat, Piter, wouldn't you say so, Feyd?"

"Yes, but—"

"Ah! Indeed *but!* But he consumes too much spice, eating it like candy. Look at his eyes! He might've come directly from the Arrakeen labor pool. Efficient, Piter, *but* he's still emotional and prone to passionate outbursts. Efficient, Piter, *but* he still can err."

Piter spoke in a low, sullen tone: "Did you call me in here to impair my efficiency with criticism, Baron?"

"Impair?" the Baron asked. "You know me better, Piter. I wish only for my nephew to understand the limitations of a Mentat."

"Are you already training my replacement?" Piter demanded.

"Replace *you?*" the Baron asked. "Why, Piter, where would I find another Mentat with the cunning and venom to meet my needs?"

"The same place you found me," Piter said.

"Perhaps I should at that," the Baron mused. "You do seem a bit unstable lately. And the spice you eat!"

"You object to my pleasures, Baron?"

"Object? My dear Piter, they are what tie you to me! How could I object to them? I merely wish my nephew to observe this about you."

"Then I'm here on display," Piter said. "Shall I dance? Shall I perform my various functions for the eminent Feyd-Rautha? Shall I—"

"You *are* on display!" the Baron said. "Precisely. Now, be silent." He glanced at Feyd-Rautha, who was staring at Piter with an amused expression. "This is a Mentat, Feyd. It has been trained to perform certain duties. The fact that it's encased in a human body, however, is not to be overlooked. I sometimes think the ancients with their machines had the right idea."

"They were toys compared to me," Piter said. "You yourself, Baron, could outperform them."

"Perhaps," the Baron said. "Ah, well." He took a deep breath, belched. "Now, then Piter—I wish you to outline for my nephew the salient features of our campaign against the House of Atreides. Function as a Mentat for us, would you please?"

"Can we trust one so young to be discreet with this information?" Piter asked. "My own observation of —"

"I'll be the judge of this," the Baron said. "I'm giving you an order, Mentat. Perform one of your various functions."

"As you wish, then," Piter said. He straightened, assuming an odd attitude of dignity—as though it were another mask, but this time clothing his entire body. "In a few days, Standard, the entire Household of the Duke Leto will embark on a Spacing Guild liner for Arrakis. The Guild will deposit them on Arrakis within a Standard Month. The Duke's Mentat, the redoubtable Thufir Hawat, having penetrated part of our campaign, will move the central party and the main fighting force to the City of Arrakeen, instead of to our city of Carthag."

"Listen carefully, Feyd," the Baron said. "Observe the plans within plans within plans."

Feyd-Rautha nodded, thinking: *This is more like it. The old monster is letting me in on secret things at last. He must really mean for me to be his heir.*

"Now, there are several possibilities," Piter said. "I've indicated that they will indeed go to Arrakis. We must not, however, overlook the possibility that the Duke has contracted with the Guild to remove him to a place of safety outside the System. Others have become Renegade Houses in like circumstances, taking their Family atomics and shields and fleeing beyond the Imperium."

"The Duke's too proud a man for that," the Baron said.

"It is, however, a possibility," Piter said. "Should he do this, though, the ultimate effect for us would be the same."

"It would *not!*" the Baron snapped. "I must have him dead and his line ended!"

"That's the high probability," Piter said. "There are certain preparations that indicate when a House is going renegade. The Duke is doing none of these things."

"So," the Baron sighed. "Get on with it, Piter."

"At Arrakeen," Piter said, "the Duke's family will occupy the old Residency, lately the home of Count and Lady Fenring."

"The Ambassador to the Smugglers," the Baron chuckled.

"What?" Feyd-Rautha asked. "Ambassador to what?"

"Your uncle makes a joke," Piter said. "He calls the Count Fenring Ambassador to the Smugglers, indicating that the Padishah Emperor has a vested interest in the Arrakeen smuggling operation . . . which he does."

Feyd-Rautha looked at his uncle, puzzled. "But how—"

"Don't be dense, Feyd," the Baron snapped. "As long as the Spacing Guild remains effectively outside the Imperial control how could conditions be otherwise? How else could spies and assassins move about?"

Feyd-Rautha's mouth made a soundless "Ohhh."

"At the Residency, we've arranged some diversions," Piter said. "There will be an attempt on the life of the son, Paul— an attempt which could succeed."

"Piter," the Baron rumbled. "You indicated—"

"I indicated that accidents can happen," Piter said. "And the attempt must appear valid."

"So," the Baron said.

"Hawat will have divined that we have an agent planted on him," Piter said. "The obvious suspect is Dr. Yueh, who is indeed our agent. But Hawat will have investigated Yueh and found that the doctor is a Suk School product with Imperial Conditioning—supposedly safe enough to administer even to the Padishah Emperor. A great store is set by Imperial Conditioning. It is assumed that this is a sort of ultimate inhibition which cannot be removed without killing the subject. However, it was said once that, given the right lever, you could move a planet. We found a lever that moved the doctor."

"How?" Feyd-Rautha asked. He found this a subject of fascination. *Everyone* knew you couldn't subvert Imperial Conditioning.

"Another time," the Baron said abruptly. "Get on with it, Piter."

"Instead of Yueh," Piter said, "we will drag across Hawat's path a most interesting suspect. The very audacity of this suspect will recommend her to Hawat's attention."

"Her?" Feyd-Rautha asked.

"The Lady Jessica herself," Piter said. "Is it not sublime? Hawat's mind will be filled with this prospect, impairing his function as a Mentat. He may even try to kill her." Piter broke off, then: "But I don't think he'll succeed."

"You don't want him to succeed, eh?" the Baron asked.

"Don't distract me," Piter said. "While Hawat is occupied with the Lady Jessica, we will divert him further with uprisings in a few garrison towns and such. The Duke must believe he's gaining a measure of success. Then, when the moment is ripe, we'll signal Yueh and move in with our major force . . . strengthened by two Legions of Sardaukar disguised in the Harkonnen livery."

"Sardaukar!" breathed Feyd-Rautha. And his mind focused on the dread Imperial troops, the killers without mercy, the soldier fanatics of the Padishah Emperor.

"You see how I trust you, Feyd?" the Baron asked. "No hint of this must ever reach another Great House, else the Landsraad might unite against the Imperial House and there'd be chaos."

"The main point," Piter said, "is this: since the House of Harkonnen is being used to do the Imperial dirty work, you have gained a real advantage. It's a dangerous advantage, to be sure, but used cautiously, the Harkonnen wealth should rival that of any House in the Imperium."

"You have no idea how much wealth is involved, Feyd," the Baron said. "Your wildest imagining would fall short of it. The beginning will be an irrevocable directorship in the CHOAM Company."

"The Duke Leto," Piter said, "may attempt to flee to the few Fremen scum along the desert's edge. Or he may try to send his family into such imagined security. That path is blocked however, by one of His Majesty's agents— the planetary ecologist. You may remember him: Kynes?"

"Feyd-Rautha remembers him," the Baron said. "Get on with it."

"You do not drool very prettily, Baron," Piter said.

"Get on with it, I command you!" the Baron roared.

"If matters go as planned," Piter said, "the House of Harkonnen will have a sub-fief on Arrakis within a Standard Year. Note this: your uncle will have the dispensation of that fief. His own *personal* agent will go there."

"More profits," Feyd-Rautha said.

"Indeed," Piter said. "And the Great Houses will *know* that the Baron had a hand in destroying the Duke. They will know."

"They will know," breathed the Baron.

"Loveliest of all," said Piter, "is that the Duke knows, too. He can feel the trap."

"It's true that the Duke knows," the Baron said. "He could not help but know, more's the pity."

The Baron moved suddenly out and away from the globe of Arrakis. As he emerged from the shadows, his figure took on dimensions—grossly, immensely fat. And with subtle bulges beneath folds of his dark gown to reveal that all this fat was partly sustained by portable suspensors. He might weigh two hundred Standard Kilos in actuality, but his feet would carry no more than fifty of them.

"I am hungry," the Baron rumbled, and he rubbed his protruding lips with a be-ringed hand, stared down at Feyd-Rautha with fat-enfolded eyes. "Send for food, my darling. We will eat."

III

Thus spoke St. Alia-of-the-Knife: "The Reverend Mother must combine the seductive wiles of a courtesan with the untouchable majesty of a virgin goddess, holding these attributes in tension so long as the powers of her youth endure. For when youth and beauty have gone, she will find that the place-between, *once occupied by tension, has become a wellspring of cunning and resourcefulness."*

"Muad'Dib, Family Commentaries"
by The Princess Irulan

"Well, Jessica, what have you to say for yourself?" asked the Reverend Mother.

It was near sunset at Castle Caladan. The two women were alone in Jessica's morning room while Paul waited in the adjoining soundproofed meditation chamber.

Jessica stood facing the south windows. She saw and yet did not see the evening's banked colors across meadows and river. She heard and yet did not hear the Reverend Mother's question.

There had been another ordeal once—many years ago. A skinny girl with hair the color of bronze, her body tortured by the winds of puberty, had entered the study of the Reverend Mother Gaius Helen Mohiam, Proctor Superior of the Bene Gesserit School on Wallach IX. Jessica looked down at her right hand, flexed the fingers, remembering the pain in detail, the terror, the anger.

"Poor Paul," she whispered.

"I asked you a question, Jessica!" The old woman's voice was snappish, demanding.

"What? Oh—" Jessica tore her attention away from the past, faced the Reverend Mother who sat with back to the stone wall between the two west windows. "What do you want me to say?"

"What do I want you to say? What do I want you to say?" The old voice carried a tone of cruel mimicry.

"So I had a son!" Jessica flared. And she knew she was being goaded into this anger deliberately.

"You were told to bear only daughters to the Atreides."

"It meant so much to him," Jessica pleaded.

"And you in your pride thought you could produce the *Kwisatz Haderach!*"

Jessica lifted her chin. "I sensed the possibility."

"You thought only of your Duke's desires for a son," the old woman snapped. "And his desires don't figure in this. An Atreides daughter could've been wed to a Harkonnen heir and sealed the breach. You've hopelessly complicated things. We may lose both bloodlines now."

"You're not infallible," Jessica said. She braved the steady stare from the old eyes.

Presently, the old woman muttered: "What's done is done."

"I vowed never to regret my decision," Jessica said.

"How noble," the Reverend Mother said. "No regrets. We shall see when you're a fugitive with a price on your head and every man's hand turned against you to seek your life and the life of your son."

Jessica paled as the Reverend Mother spoke. "Is there no alternative?"

"Alternative? A Bene Gesserit should ask that?"

"I ask only what you see in the future with your superior abilities."

"I see in the future what I have seen in the past. You well know the pattern of our affairs, Jessica. The race knows its own mortality and fears stagnation of its heredity. It's in the bloodstream—an urge to mingle genetic strains. The Imperium, the CHOAM Company . . . all the Great Houses, they are but bits of flotsam in the path of this flood."

"Would you have me return to basic history for understanding of my present problems?" Jessica asked.

"Don't be facetious, girl! You know as well as I do what forces surround us. We have a three-point civilization: the Imperial Household balanced against the Federated Great Houses, and between them the Guild with its monopoly on interstellar transport. In politics, the tripod is the most unstable of all structures. It'd be bad enough without the framework being complicated by our feudal trade culture which turns its back on science."

Jessica spoke bitterly: "And this chip floating here, this is the Duke Leto, and this is his son, and this—"

"You entered this with full knowledge of what a delicate edge we walk," the Reverend Mother said. "Our rulers fear strength. They know the dangers of too much science. If the tripod falls the wrong way, it could scatter the human stock beyond any regathering . . . yet the Bene Gesserit plan must have that critical mass of fertile humans. If they scatter beyond our reach . . . centuries of work wasted. Wasted! Yet, if we show our hand, reveal our strength and purpose, we invite destruction."

"I am Bene Gesserit; I exist only to serve," Jessica muttered.

"Truth," the old woman said. "All we can hope to do is to prevent this from erupting into general conflagration, salvage what we can of the key bloodlines."

The old woman's voice softened. "Jessica, girl, I wish I could stand in your place and take your sufferings. But each of us must make her own mistakes."

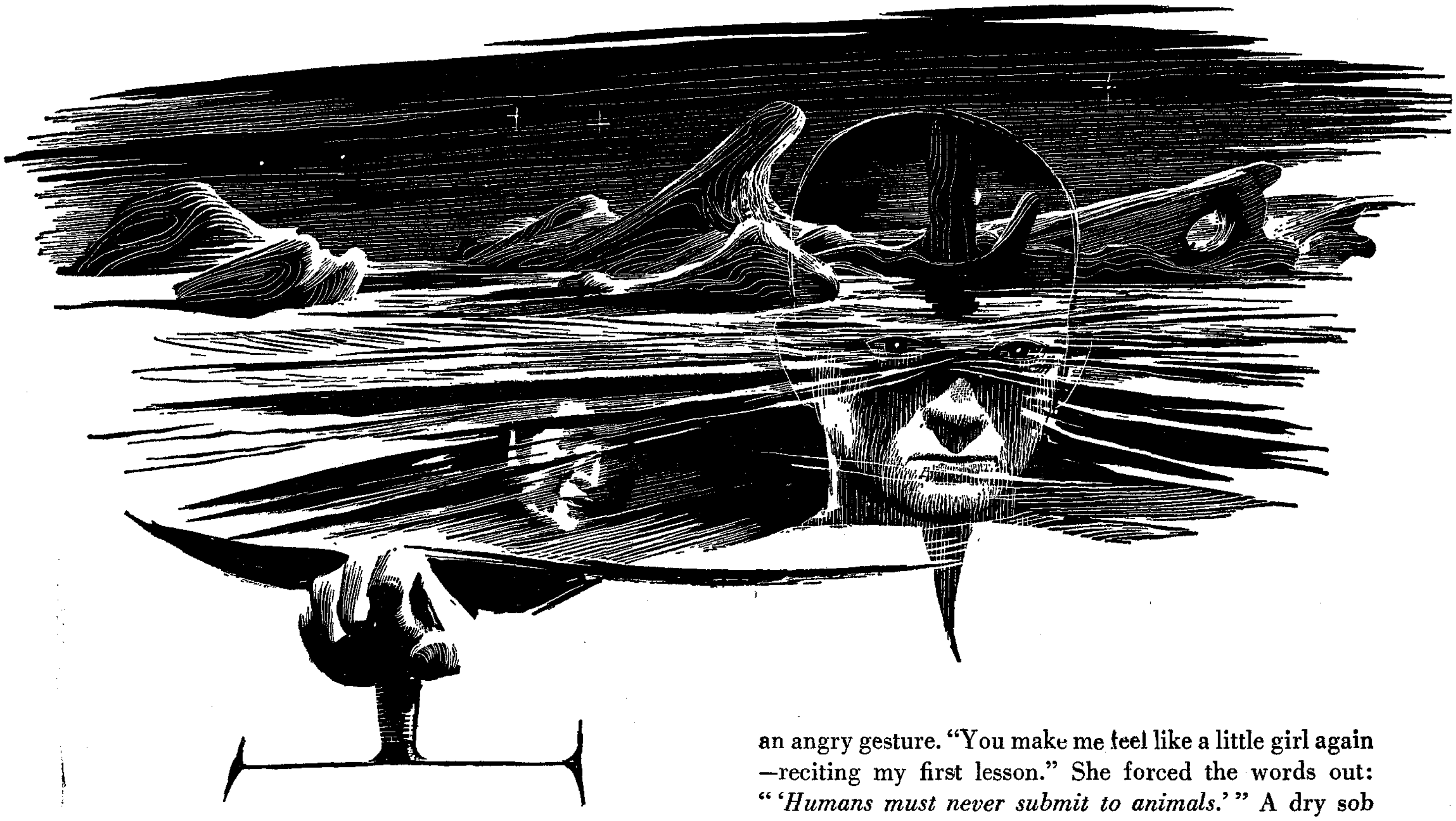
"I know."

"You're as dear to me as any of my own daughters, but I cannot let that interfere with duty."

"I understand . . . the necessity."

"What you did, Jessica, and why you did it—we both know. But kindness forces me to tell you there's so little chance that your lad will be the Bene Gesserit Totality. You must not let yourself hope too much."

Jessica shook tears from the corners of her eyes. It was an angry gesture. "You make me feel like a little girl again—reciting my first lesson." She forced the words out: "*'Humans must never submit to animals.'*" A dry sob shook her. In a low voice, she said: "I've been so lonely."



"It should be one of our tests," the old woman said. "Humans are almost always lonely. Now summon the boy. He's had a long and frightening day. But I have a few more questions about these dreams of his."

"Do these dreams not suggest the thing we seek?" Jessica asked.

"Do not hope too much, girl."

Jessica nodded, went to the door of the Meditation Room, opened it. "Paul, come in now, please."

Jessica closed her eyes, feeling tears press out beneath the lids. She fought down the inner trembling, the outer trembling, the uneven breathing, the ragged pulse, the sweating of the palms. Presently, she said: "I'll pay for my own mistake."

"And your son will pay, too."

"I'll shield him as well as I'm able."

"Shield!" the old woman snapped. "You well know the weakness there! Shield your son too much, Jessica, and he'll not grow strong enough to fulfill *any destiny*."

Jessica turned away, looked out the window. "Is it really that terrible, this planet of Arrakis?"

"Bad enough, but not all bad. The Missionaria Protective has been in there and softened it up somewhat." The Reverend Mother heaved herself to her feet, straightened a fold in her gown. "Summon the boy. I must be leaving soon."

"Must you?"

Paul entered the Morning Room with a stubborn slowness. He stared at his mother as though she were a stranger. Wariness veiled his eyes when he glanced at the Reverend Mother, but this time he nodded to her, the nod one gives an equal. He heard his mother close the door behind him.

"Young man," said the old woman, "let's go through that dream business again."

"What do you want?" he asked. "I've told you how I remember all my dreams."

"All of them?"

"If I need to remember them."

"Do you dream every night?"

"Not dreams worth remembering. I can remember every dream, but some are worth remembering and some aren't."

"Ohhh." The old woman glanced at Jessica, back to Paul. "What dream did you dream last night?"

Paul closed his eyes. "About a cavern . . . and water . . . and a girl there—very skinny with big eyes. Her eyes are all blue. They don't have any whites in them. I talk to her and I tell her about you, about seeing the Reverend Mother on Caladan." Paul opened his eyes.

"And the thing you told this strange girl about seeing me, did it happen today the way you told it?"

Paul thought about this, then: "Yes. I told the girl you came and put a stamp of strangeness on me."

"Stamp of strangeness," the old woman breathed, and again she shot a glance at Jessica, returned her attention to Paul. "Tell me truly now, Paul, do you often dream a thing and have the dream happen exactly as you dreamed it?"

"I told you I did. Yes. Many times."

"Tell me of another time."

"I've dreamed about the strange girl before."

"Oh? Do you know her?"

"No. But I will know her."

"Tell me another dream about her."

Again, Paul closed his eyes. "We're in a little place in some rocks where it's sheltered. It's almost night, but it's hot and I can see patches of sand out an opening in the rocks. We're waiting for something . . . for me to go meet some people who're waiting for me. And she's frightened but trying to hide it from me, and I'm excited. And she says: 'Tell me about the waters of your homeworld, Usul, my Muad'Dib.'" Paul opened his eyes. "Isn't that strange? My homeworld's Caladan. I've never even heard of a planet called Usul."

"Is there more to this dream?" Jessica prompted.

"Yes. Maybe she was calling *me* Usul," Paul said. "I just thought of that." Again, he closed his eyes. "She asked me to tell her about the waters. And I take her hand. She has nice hands. And I say I'll tell her a poem. And I tell her the poem, but I have to explain some of the words—like beach and surf and seaweed and seagulls."

"What poem?" the old woman asked.

Paul opened his eyes. "It's just one of Gurney's tone poems for sad times."

Behind Paul, Jessica began to recite:

"I remember salt smoke from a beach fire
"And shadows under the pines—
"Solid, clean, fixed—
"Seagulls perched at the tip of land,
"White upon green . . .
"And a wind came through the pines
"To sway the shadows.
"The seagulls spread their wings,
"Lifted
"And filled the sky with screeches.
"And I heard the wind
"Blowing across the beach,
"And the surf,
"And I saw that our fire
"Had scorched the seaweed."

"That's the one," Paul said.

The old woman stared at Paul, then: "Young man as a Proctor of the Bene Gesserit, I seek continually for the *Kwisatz Haderach*, the male who can truly become one of us. Your mother sees this possibility in you, but she sees with the eyes of a mother. Possibility, this I see, too. But I cannot label it more."

She fell silent, and Paul saw that she wanted him to speak. He waited her out.

Presently, she said: "As you will, then. You've depths in you; I'll grant that."

"May I go now?" he asked.

"You don't want to hear what I can tell you about the *Kwisatz Haderach?*"

"You said those who tried for it died."

"But I can help you with a hint at the reason for their failure."

"Hint then."

She smiled wryly. "Very well: *That which submits rules.*"

"That's a hint?"

She nodded.

"Ruling and submitting are opposites," he said.

"Is the place between them empty?" Jessica asked.

"Ohhh." He kept his attention on the old woman. "You mean what my mother calls the tension-within-meaning." He pursed his lips. "That which submits rules."

"We're not here just to bandy words or quibble over interpretations," the old woman said. "The willow submits to the wind and prospers until one day it is many willows—a wall against the wind. Animal-humans and the animal nature in true humans blunders along like the wild wind. You must bend to this, but keep your roots firmly planted. You must learn to use the wind, to gain strength from it, use it for your own purposes."

Paul stared at her. She spoke of purposes, and again he felt himself infected by Terrible Purpose.

"Do you understand what she's saying?" Jessica asked.

"I'm trying to understand it."

"It'll come to you without trying," Jessica said.

"You think I could be this . . . *Kwisatz Haderach* . . . and you want me to rule . . . the way you say . . . but I—"

"We merely want you to work at becoming a Bene Gesserit!" the old woman snapped. "You may never have a chance to rule."

"I've been taught to guard against Harkonnens," he said.

"Well taught, too, I have no doubt," she said. "But you're the end *viant* of the Atreides central line, the main bloodline."

"You must guard yourself for your father's sake," Jessica said. "For the sake of all the other Atreides who've come to this . . . to you."

"You haven't told me what we can do about my father," Paul said. "You talk as though—"

"Nothing!" the old woman barked. "If there were a thing to be done, we'd have done it. We may be able to salvage you. Doubtful, but possible. When you've learned to accept this as fact, you've learned a *real* Bene Gesserit lesson."

Paul chewed at his lower lip. How could they say such a thing about his father? His mind seethed with resentment. What made them so sure?

The Reverend Mother looked at Jessica. "I've seen the signs of it—I know you've been training him in the Way. I'd have done the same in your shoes and devil take the Rules."

Jessica nodded.

"Now," said the old woman, "I caution you to ignore the regular order of training. His own safety requires the Voice. He already has a start in it, but we both know how much more he needs . . . and desperately." She stepped up to Paul, stood looking down at him. "Good-by, young human. I hope you make it. But if you don't . . . all will not be lost. We will yet succeed—sometime."

Once more, she looked at Jessica. A flicker-sign of understanding passed between them. Then, the old woman swept from the room, her robes hissing, and not another backward glance. The room and its occupants already were shut from her thoughts.

But Jessica had caught one glimpse of the Reverend Mother's face as she turned away. There had been tears on the seamed cheeks. The tears were more unnerving than any of the words or signs that had passed between them.

IV

You have read that Muad'Dib had no playmates his own age on Caladan. The dangers of a false friend were too great. His family was relatively poor; their enemy rich. But Muad'Dib did have wonderful companion-teachers. There was Gurney Halleck, the troubadour warrior. You will sing some of Gurney's songs as you read along in this book. There was Thufir Hawat, the old Mentat Master of Assassins, who struck fear even into the heart of the Padishah Emperor. And there were Duncan Idaho, the Sword Master of the Ginaz; Dr. Wellington Yueh, a name black in treachery but bright in knowledge; the Lady Jessica, who guided her son in the Bene Gesserit Way, and, of course, the Duke, whose great qualities as a father have long been overlooked.

"A Child's History of Muad'Dib"
by The Princess Irulan

Thufir Hawat slipped into the training room of Castle Caladan, closed the door softly. He stood there a moment feeling tired, feeling as old and storm-leathered as he knew he looked. His left leg ached where it has been slashed once in the service of the Old Duke.

Three generations of them now, he thought.

He stared across the noon-lighted open room at the boy seated with back to the door, intent on papers and maps spread across an ell table.

How many times must I tell that lad never to settle himself with his back to a door? Hawat cleared his throat.

Paul remained bent over his studies.

Again, Hawat cleared his throat.

Paul straightened, spoke without turning: "I know. I'm sitting with my back to the door."

Hawat suppressed a smile, strode across the room.

Paul turned, looked up at the grizzled man who stopped at the corner of the table. Hawat's eyes were two pools of alertness in a dark and deeply seamed face.

"I heard you coming down the hall," Paul said. "And I heard you open the door."

"The sounds I make could be imitated," Hawat said.

"I'd know the difference."

He might at that, Hawat thought. *That witch-mother of his is giving him the deepest training, certainly.*

Hawat pulled up a chair across the ell table from Paul, sat down facing the door. He did it pointedly, and leaned back, studying the room. It struck him as an odd place suddenly, most of its hardware already bound for Arrakis. There remained only the fencing mirror with its crystal prisms quiescent, the target dummy beside the mirror—patched and padded, looking like an ancient footsoldier maimed and battered in the wars.

There stand I, Hawat thought.

"What're you thinking, Thufir?" Paul asked.

Hawat looked at the boy. "I was thinking we'll all be out of here in a few days and likely never see the place again."

"Does that make you sad, too?"

"Sad? Nonsense! Parting with friends is a sadness. A place is only a place." He glanced at the papers and maps on the table. "And Arrakis is another place."

"Thufir, did my father send you up to test me?"

Hawat scowled, then nodded. "You've observing ways about you. And I know you're thinking it'd have been nicer if he'd come up himself. But he'll be along later. You must know how busy he is."

"Yes."

"What've you learned from these charts of Arrakis?"

Paul glanced down to the table at a conical projection chart of the northern Arrakeen latitudes, said: "This is the habitable area. The desert belt and south polar regions are marked uninhabitable." He looked up. "Is that really true?"

"Oh, any place can be made habitable, I guess," Hawat said. "But you always have to figure the cost. The mountains, the ones there along the northern edge of the desert that they call 'The Shield Wall,' they're a natural barrier. They keep out the main force of the desert storms and reduce the cost of living, so to speak."

"There're no mountains in the south?"

"Clean flat."

"I guess the storms are pretty bad."

"That's too cautious a word: bad. Those storms can build up across six or seven thousand kilometers of flatlands. They feed on each other and gain power as they join. Coriolis force pushes them, and gravity from the moons and the sun and anything else that has an ounce of energy in it. They build up to more'n five hundred kilometers an hour, loaded with sand and dust and everything loose that's got in their way"—he took a deep breath—"and they slam into anything that gets in their path. They eat flesh off bones and etch the bones to slivers."

Paul continued to stare at Hawat, thinking about such a storm. Presently, he said: "It seems to me weather-control satellites would pay for themselves."

"It's a thing to be considered," Hawat said. "But Arrakis has special weather problems. The cost would be dreadful even if the Spacing Guild could be talked into it . . . and there'd be the maintenance costs and the like. Your father's House isn't one of the great rich ones, lad. You know that."

"We might be able to do something on the surface, though. Perhaps we could control the sandworms."

"Did Yueh give you any idea of the size of those worms?"

"He showed me a filmbook." Paul closed his eyes and called up the book's commentary, reciting it: "This is a small specimen, only one hundred and ten meters long and twenty-two meters diameter. Worms of more than four hundred meters' length and corresponding diameter have been recorded by reliable witnesses, and there's reason to believe even larger ones roam the deep equatorial regions." Paul opened his eyes. "The man was describing a dead worm. He said the Fremen produced it for him as a specimen. Have you ever seen the Fremen?"

"Like as not I have. There's little difference in appearance between them and the townfolk. They all wear these great flowing robes. And they stink to heaven in any closed space. It's from these suits they wear beneath their robes—call them 'still-suits'—that're supposed to reclaim the body's own water."

Paul swallowed, suddenly aware of the moisture in his mouth. The idea that people could want so for water that they had to recycle their body moisture struck him with a feeling of desolation. "Is water that precious?" he asked.

Hawat nodded, and he thought: *Perhaps I'm doing it. Perhaps I'm getting across to him at last—the importance of the planet as an enemy.*

"Water?" Paul looked up at the skylight above them, aware that it had begun to rain several minutes before. He saw the spreading wetness on the gray meta-glass. "Water?"

"You'll learn a great concern for water on Arrakis," Hawat said. "As the Duke's son you'll never want for it, but you'll see the pressures of thirst all around."

Paul thought back to his day with the Reverend Mother, the test of the *gom jabbar.* She'd said something about water starvation, too, but his mind had been too full then with the memory of pain and the fearful prophecy she had cast upon him.

"You'll learn about the funeral plains," she'd said, "about the wilderness that is empty, the wasteland where nothing lives or grows except the spice and the sandworms. You'll learn to stain your eyepits to reduce the sun's glare. Shelter will come to mean a hollow out of the wind and hidden from view. You'll learn to ride upon your own two feet without aircraft, groundcar or mount."

And Paul had been caught more by the tone of her voice—singsong and wavering—then by her words.

"When you live upon Arrakis," she had said, "*khala,* the land that is empty, the moons will be your friends and the sun your enemy."

Paul had felt his mother come up beside him, away from her post guarding the door. She had looked at the Reverend Mother and asked: "Do you see no hope, Your Reverence?"

"For your son, yes, but not for the father." And the old woman had waved Jessica to silence, looked down at Paul. "I enjoin you to grave this into your memory: A world is supported by four things"—She held up four big-knuckled fingers—"the learning of the wise, the justice of the great, the prayers of the righteous and the valor of the brave. But all of these are as nothing"—she closed her fingers into a fist—"without a ruler who knows the art of ruling. Make *that* the science of your tradition!"

Now, sitting with Thufir Hawat in the training room, Paul looked across at the Mentat's puzzled frown. A week had passed since that terrible day with the Reverend Mother. Her words were only now beginning to come to full register.

"Where were you woolgathering that time?" Hawat asked.

"Did you meet the Reverend Mother when she came to visit?" Paul asked.

"That Truthsayer witch from the Imperium?" Hawat's eyes quickened with interest. "I met her, but I've not fathomed the purpose of her visit or why she was so crony-crony with you and your mother."

"She—" Paul hesitated, found that he could not tell Hawat about the test. The inhibition went deep.

"Yes? What did she?"

Paul took two deep breaths. "She said a thing to me." He closed his eyes, calling up the words, and when he spoke, his voice unconsciously took on some of the old woman's tone: "*'You, Paul Atreides, descendant of kings, son of a Duke, you must learn to rule. It's something none of your ancestors have learned.'* " Paul opened his eyes, said: "That made me angry, and I said to her that my father rules an entire planet. And she said: *'But he's losing it.'* And I said that my father was getting a richer planet. And she said: *'He'll lose that, too.'* And I wanted to run and warn my father, but she said he'd already been warned . . . by you, by my mother, by many people."

"That's true enough," Hawat muttered.

"Then why are we going?" Paul demanded.

"Because the Padishah Emperor orders it," Hawat said. "And because there's hope in spite of what that witch-spy said. What all did she tell you?"

"She told me a world's the sum of many things."

"She what?"

"I mean—like the people, the dirt, the growing things, the moons, the tides, the sun. Like that. She said this was the unknown sum we call *nature.* But she said it's vague, without a *now,* that when you try to break it down for analysis, *it* has already moved on."

"Did you make any sense out of that, lad?" Hawat asked, and he frowned, thinking: *She was just paraphrasing the First Law of Mentat for him.*

"I . . . think so," Paul said.

Why would she take time for that when she knows this lad must be far beyond such kindergarten stuff?

"It's just the First Law of Mentat," Paul said, and he quoted: *"A process cannot be understood by stopping it. Understanding must move with the flow of the process, must join it and flow with it."*

"I'd have been surprised if you hadn't seen it," Hawat said. "What else spouted from this ancient fountain of wisdom?"

Paul looked down at his right hand clenched into a fist beneath the table, and slowly willed the muscles to relax. *She put some kind of hold on me,* he thought. *What was it?*

"She asked me to tell her my understanding of what it is to rule," Paul said. "And I said that one commands. And she said I had some unlearning to do."

She hit a mark there, right enough, Hawat thought. He nodded for Paul to continue.

"Then she said a ruler must learn to persuade and not to compel. She said he must lay the best coffee hearth to attract the finest men."

"How'd she figure your father attracted men like Duncan Idaho and Gurney Halleck?" Hawat asked.

Paul shrugged. "Then she said a funny thing: she said a good ruler has to learn his world's language, that it's different for every world. And I thought she meant they didn't speak Galach on Arrakis, but she said that wasn't it at all. She said she meant the language of the rocks and growing things, the language you don't hear just with your ears. And I said that's what Dr. Yueh calls the Mystery of Life."

Hawat chuckled. "How'd that sit with her?"

"She seemed to get mad. She said the mystery of life isn't a problem to be solved, it's a reality to be experienced. She said I'd have to . . . woo my world . . . seduce it and not fight it."

"Not fight it?" Hawat's face betrayed outrage.

"I'm just telling you what she said."

Mish-mash, Hawat thought. *Was it a deliberate attempt to confuse the boy and frighten him?*

"Thufir," Paul said, "is Arrakis going to be as bad for my father as she said?"

"Nowhere near it," Hawat said.

"You *know* something," Paul said. "Please tell me."

I can tell you a little, perhaps," Hawat said. "It's to do with the Fremen, the renegade people of the desert. I've a first-approximation-analysis on them: there're many more of them than the Imperium knows about . . . and"—Hawat put a sinewy finger beside his eye—"they hate the Harkonnens bitterly, all of them. I tell you this, lad, as your father's helper. You must not breathe a word of it to anyone."

"I won't. Do you think they'll help us?"

"It's a possibility. That's all I can say." Hawat stood up. "I leave today for Arrakis. Now, you take care of yourself for an old man who's fond of you, heh? Come around here like a good lad and sit facing the door. It's not that I think there's any danger here. It's just a habit I want you to form."

Paul got to his feet and moved around the table. "You're going to Arrakis . . . today?"

"Today it is," Hawat said, "and you follow tomorrow. Next time we meet it'll be on the soil of your new world." He gripped Paul's right arm. "Keep your knife arm free, heh? And your shield at full charge." He patted Paul's shoulder, whirled and strode quickly to the door.

"Thufir!" Paul called.

Hawat turned, standing in the open door.

"Don't sit with your back to any doors," Paul said.

A grin spread across the seamed old face. "That I won't, lad. Depend on it." And he was gone out the door, shutting it softly behind him.

Paul sat down where Hawat had been, straightened the papers. *Maybe I helped by telling Thufir those things,* he thought. *But I didn't tell him everything. I couldn't.*

The door across the room banged open. Gurney Halleck entered, carrying the weapons under his arm—the rapiers, the bodkins, the kindjals, the slow-pellet stunners, the shield belts. He saw Paul seated across from him at the ell table, noted that Hawat's men already had been over the area checking it, making it safe for a Duke's heir. Subtle code signs were all around—the target dummy positioned just so, the chalked symbol-of-the-day on ceiling beams and skylights.

Paul watched the rolling, ugly lump of a man veer toward the training table, saw the nine-string baliset slung over Gurney's shoulder on its cord, the multipick woven through the strings near the head of the fingerboard.

The inkvine scar along the man's jawline writhed as he cast a smile across the room and called: "A good morning, you young imp! What barb did you sink into old Hawat? He passed me like a man running to his enemy's funeral."

Paul grinned. Of all his father's men, he liked Gurney Halleck best. He knew the man's moods and deviltry, the *humor* of him, and thought of him more as a friend than as a hired sword.

Gurney dropped the weapons onto the exercise table, swung the baliset off his shoulder, began checking its tune.

"Well, Gurney Halleck," Paul said, and he stood and advanced across the room. "Do we come prepared for music when it's fighting time?"

Gurney tried a chord on the instrument. "So it's sass for our elders today," he said.

"Where's Duncan Idaho?" Paul asked. "Isn't he supposed to be teaching me weaponry?"

"Duncan's gone to lead the second wave onto Arrakis," Gurney said. "As you well know. All you have left is poor Gurney who's fresh out of fight and spoiling for music." He struck another chord, listened to it, nodded. "And it was decided in council that you being such a poor fighter we best teach you the music trade so's you won't waste your life." He swung into "Galacian Girls," his multipick a blur over the strings as he sang:

"Oh, the Galacian girls
"Will do it for pearls,
"And the Arrakeen for water!
"But if you desire dames
"Like consuming flames,
"Try a Caladanin daughter!"

"Not bad for such a poor hand with the pick." Paul said "but if my mother heard you singing a bawdy like that in the castle, she'd have your ears on the outer wall for decoration."

Gurney pulled at his left ear. "Poor decoration, too, they having been bruised so much listening at keyholes while a young lad I know practiced some strange ditties in his baliset."

"So you've forgotten what it's like to find sand in your bed," Paul said. He pulled a shield belt from the table, buckled it fast around his waist. "Then, let's fight!"

Gurney's eyes widened in mock surprise. "So! So it was your wicked hand did that deed! Guard yourself today, young master . . . guard yourself." He grabbed up a rapier, laced the air with it. "I'm a hellfiend out for revenge!"

Paul lifted the companion rapier from the table, bent it in his two hands, stood in the *aguile*, one foot forward. He let his manner go solemn in a comic imitation of Dr. Yueh.

"What a dolt my father sends me for a weapons teacher," Paul intoned. "This doltish Gurney Halleck has forgotten the first lesson for a fighting man armed and shielded." Paul snapped the force button at his waist, felt the crinkled-skin tingling of it around his forehead, heard all external sounds take on shield-filtered flatness. "In shield-fighting, one must move fast on defense, slow on attack. The attack has the sole purpose of tricking an opponent into a misstep, setting him up for the attack sinister. One must always remember that the shield turns the fast blow and admits the slow kindjal!" Paul snapped up the rapier, feinted fast and whipped it back in a slow thrust timed precisely to enter a shield's mindless defense.

Gurney watched the action critically, turned at the last minute to let the blunted blade pass his chest. "Speed, excellent," he said. "But you were wide open for an underhanded counter with a poison needle or slip-tip."

Paul stepped back, chagrined.

"To paraphrase an expert I heard recently on this subject," Gurney said, "it's not the blow you aim that's important, it's the one you hold in reserve. The feint goes thusly, you see." And Gurney demonstrated, thrusting high with an apparently foolish speed as Paul fell back. "And thus! It lets your opponent move in a way . . . that sets him up for . . . the sinister hand."

And Paul found himself turned backward over the exercise table, exposed to a blunted kindjal on his left and inside the shield's aura.

"I should whap your backsides for letting me get that close to you," Gurney said. He pulled back and straightened, slipped the guard off the kindjal and held up the naked blade. "This in the hand of an enemy can let out your life's blood! What is it with you today, lad? In all truth, I've never had a more apt pupil, yet you permit me into your guard with death in my hand."

"I guess I'm not in the mood for it today," Paul said.

"Mood?" Gurney's voice betrayed outrage, even through the shield. "What has *mood* to do with it? You fight when the necessity arises—no matter your *mood!* Mood's a thing for cattle or for making love or playing the baliset. It's not for fighting. You haven't let me that close to you in over a year!" He flicked the blunting sheath to the floor, activated his shield, crouched with blade outthrust in his left hand, the rapier poised high in his right. "Now, I say guard yourself for true!" He leaped to one side, then forward, pressing a furious attack.

Paul fell back, parrying the rapier. He felt the shield edges touch and repel, sensed the electric tingling of the contact. *"What's gotten into Gurney?"* He asked himself. *"He's not faking."* Paul moved his left hand, dropped his bodkin into his palm from its wrist sheath.

"You see the need for an extra blade, eh?" Gurney grunted.

Around the room they fought—thrust and parry. The air within their shield bubbles grew stale from the demands on it and the slow interchange along the barrier edge. There was a taint of ozone in it from shield contacts.

Paul continued to back, but now he directed his retreat toward the exercise table. *If I can turn him beside the table, I'll show him a trick,* Paul thought. *Just one more step.*

Gurney took the step. Paul directed his next parry down, turned, saw Gurney's rapier catch against the table edge. Paul flung himself aside, thrust high with the rapier and came in across Gurney's neckline with the bodkin. He stopped the blade an inch from the jugular.

"Look down, lad," Gurney panted.

Paul obeyed, saw Gurney's kindjal thrust under the table edge, the tip almost touching Paul's groin.

"We'd have joined each other in death that time," Gurney said. "But I'll admit you fought some better when pressed to it. You seemed to get the *mood* of the fight." And he grinned wolfishly, the inkvine scar rippling along his jaw.

"The way you came at me," Paul said. "Would you really have drawn my blood?"

"If you'd fought beneath your abilities one little bit," Gurney said, "I'd have scratched you a good one, a scratch to leave a scar you'd remember. I'll not have a pupil of mine fall to the first Harkonnen tramp who happens along." He withdrew the kindjal, straightened.

Paul leaned on the table, taking a moment to catch his breath. "I deserved that, Gurney. I know it, but it would've angered my father if you'd hurt me. I'll not have you punished for my failing."

"Well, now, lad," Gurney said, "as to that: it was my failing, too. And you needn't worry about a training scar or two. You're lucky you have so few. As to your father, the Duke, he'd punish me only if I failed to make you a first-class fighting man. And I'd have been failing that, too, if I hadn't pointed out the fallacy in this *mood* thing."

Paul slipped his bodkin back into its wrist sheath, turned off his shield belt. Gurney nodded, sheathed the kindjal and deactivated his own belt.

"It's not exactly play we do here," Gurney said, and his voice had regained its fullness in the absence of the shields.

Paul nodded. There was an uncharacteristic seriousness in Gurney's manner, an intensity that sobered the boy. Paul looked at the beet-colored scar of the inkvine whip on the man's jaw, really seeing it and remembering the story about how it had been put there by Beast Rabban in a Harkonnen slave pit on Giedi Prime. And for the first time, it occurred to Paul that the making of that scar had been accompanied by pain . . . a pain as intense, perhaps, as that inflicted by the Reverend Mother on his hand. Paul thrust the thought aside. It chilled their world.

"I guess I did come in here hoping for some play," Paul said. "But things are so serious around here lately."

Gurney turned quickly to hide his emotion. Something burned in his eyes. There was pain in him—like a blister—all that was left of some lost yesterday that time had pruned off him.

How soon this child must assume his manhood, Gurney thought. *How soon to find that form in the mind, that contract of caution, and to see that you must enter the necessary things on the necessary line: 'Please list your next of kin.'*

Gurney spoke without turning: "I sensed the play in you, lad, and I'd like nothing better than to join in it. But this cannot be play any longer. This is real. The planet we go to, this Arrakis, is real. The Harkonnens are real."

"Some day, I'll kill that Rabban for you," Paul said.

"If the chance ever comes to that, I'll do the deed myself," Gurney said. "But it's his uncle the Baron we want. He's the one taught Rabban all he knows. If you'd destroy an evil growth, cut out the root."

Paul touched his forehead with his rapier blade held vertical.

Gurney acknowledged the salute with a nod, gestured to the practice dummy. "Now, shall we work on something that can be accomplished in the immediate future? Let me see you catch that thing sinister. I'll control it from over here where I'll have a full view of the action. And I warn you I'll be trying some new counters. That's a warning you'd not get from a real enemy."

Paul stretched up on his toes to relieve his muscles. He felt solemn with the knowledge that his life was changing so rapidly. First, the old woman—the Reverend Mother; and now, this sober and intense Gurney Halleck. Paul turned, crossed to the dummy. He slapped the switch on its chest with his rapier tip, felt the field there forcing out his blade.

"En garde!" Gurney called, and the dummy pressed the attack.

Paul parried and countered.

Gurney watched as he manipulated the controls. His mind seemed to be in two parts: one alert to the needs of the fight, and the other wandering through what he called *fly-buzz.*

I'm like a well-trained fruit tree, he thought. *Full of well-trained feelings and all of them grafted onto me . . . all bearing fruits for someone else to pick—not that I truly resent this . . .*

And for some reason, he suddenly recalled his younger sister, her elfin face so clear in his mind. But she was dead now . . . in a pleasure house for Harkonnen troops. She had loved pansies. Or was it daisies? He couldn't remember. And it bothered him that he couldn't remember.

Paul countered a slow swing of the dummy, brought up his left hand *entretisser.*

That clever little devil, Halleck thought, intent now on Paul's interweaving hand motion. *He's been practicing and studying on his own. That's not Duncan's style, and it's certainly not something I've taught him.*

But this thought only added to Gurney's sadness. He began to wonder about Paul, if the boy ever listened fearfully to his pillow throbbing at night.

". . . If wishes were fishes we'd all cast nets," Halleck murmured. It was his mother's expression and he always used it when he felt the blackness of tomorrow on him. Then he thought what an odd expression that was to be taking to a planet which had never known seas or fishes.

V

YUEH (yü'a), Wellington (wel'ing-tun), Stdrd 10,082-10,191; medical doctor of the Suk School (grd Stdrd 10,112); md: Wanna Marcus, BG (Stdrd 10,092-10,186?); chiefly noted as betrayer of Duke Leto Atreides. (cf: bibliography, appendix VII [*Imperial Conditioning*] *and Betrayal, The.)*

"Dictionary of Muad'Dib"
by The Princess Irulan

Although he heard Dr. Yueh enter the training room, noting the stiff deliberation of the man's walk, Paul remained stretched out face down on the exercise table where the masseuse had left him. He felt deliciously relaxed after the workout with Gurney.

"You do look comfortable," Dr. Yueh said in his calm, high-pitched voice.

Paul raised his head, saw Yueh's stick figure standing several paces away, took in at a glance the wrinkled clothing, the square block of a head with its purple lips and drooping mustache, the diamond tattoo of Imperial Conditioning on his forehead, the long black hair caught in the Suk School's silver ring at his left shoulder.

Paul rested his chin on his crossed hands. "Do we have to dig into the books today?"

Behavior is that over which we have control, Dr. Yueh reminded himself. He said: "I should imagine that's been the complaint of students since the dawn of history. You'll be happy to hear that we do *not* have time for a regular lesson."

Paul sat up.

"However, I've arranged for you to have a filmbook viewer with several lessons during the crossing to Arrakis."

"Oh."

"Hurry and get dressed, young master Paul," Yueh said.

Paul began pulling on his clothes.

Yueh crossed to the ell table, thinking: *How the boy has filled out these past few months. Such a waste! Oh, such a sad waste!* And he reminded himself: *What I do is done to be certain my Wanna can no longer be hurt by the Harkonnen beasts.*

Paul joined him at the table. "What'll I study on the way across?"

"Ahh, the terranic life forms of Arrakis. It is strange, but the planet seems to have opened its arms to certain terranic forms. It's not at all clear how. I must seek out the planetary ecologist when we arrive—a Dr. Kynes—and offer my services in the investigation."

And Yueh thought: *What am I saying? I play the hypocrite even with myself.*

"Could you give me something about the Fremen?" Paul asked.

"The Fremen." Yueh drummed his fingers on the table, caught Paul staring at the nervous motion, withdrew his hand.

"Maybe you have something on the whole Arrakeen population," Paul said.

"Yes," Yueh said. "There are two general separations of people there—Fremen and Pan or Graben. There's some intermarriage between them. The women of the pan and sink villages prefer Fremen husbands; their men prefer Fremen wives. They have a saying: 'Polish comes from the cities; Wisdom from the desert.' "

"Where are they from?" Paul asked.

Yueh eased himself stiffly onto the edge of the table, dangled one leg. "It is said they're descended from the Eight and Fifty—the ones who migrated to Richessa."

"I read a fiction about them once," Paul said. "The Sardaukar subjugated them and relocated them on an uninhabited planet."

"That was not entirely fiction," Yueh said.

"There were eight men and fifty women," Paul said.

"Yes, the Eight and Fifty, the Lost People."

"Do you have pictures of them?" Paul asked.

"I'll see what I can get you. You'll find their garb interesting—such utilitarian simplicity: the *jubba* cloak for protection against sun, wind and sand . . . and beneath it the stillsuit which recycles their body moisture. The most interesting thing about them, though, is their eyes: totally blue—no whites in them at all."

"Why? Is it a mutation?"

"My own theory is that it's linked to a blood saturation with melange, the spice. I've seen a decided blue cast in the eyes of some who use melange to excess. And I know of one person who virtually lives on it; his eyes are blue like that."

"He must be rich."

"He has a rich patron."

And Yueh thought: *Do I hope this story will get back to Hawat, who'll suspect it's Piter? Perhaps I do. Certain it is that I don't want to do what I must.*

"The Fremen must be brave to live at the edge of that desert," Paul said.

"By all accounts. They compose poems to their knives. Their women are as fierce as the men. Even little children are violent and dangerous."

Paul stared at Yueh, finding in even these few glimpses of the Fremen a power of words that caught his entire attention. *What a people to win for allies!*

"They have a common saying," Yueh said. "They say: 'He died Fremen' or 'He died in the desert.' It means they don't know exactly how the person met death."

Paul nodded. "Hawat says of some people: 'They died of . . . man.' "

"That sounds like Hawat," Yueh said. He smoothed his drooping mustache. "I must leave in a few minutes. Your father will be along soon. Before I go, however, I've a gift for you, something I came across in packing." He put an object on the table between them—black, oblong, no larger than the end of Paul's thumb.

Paul looked at it and Yueh noted that the boy did not reach for it. *How cautious he is,* Yueh thought.

"It's very old and rare," Yueh said. "An Orange Catholic Bible made for space travelers. Not a filmbook, but actually printed on filament paper. It has its own magnifier and electrostatic charge adjustment." He picked it up, demonstrated. "The entire book is held closed by the charge forcing against springlocked covers. You press the edge . . . thus, and the pages you have selected repel each other and the book opens."

"It's so small," Paul said.

"Yet it has eighteen hundred pages," Yueh said. "When you press the edge . . . thus, the charge moves ahead one page at a time as you read. You must never touch the actual pages with your fingers. The filament tissue is too delicate." He closed the book, pressed it into Paul's hand. "Here. You try it."

Yueh watched as Paul worked the adjustment to turn the pages. *I salve my own conscience,* he thought. *I give him the surcease of religion before betraying him. Thus may I say to myself that he has gone to a place where I may never go.*

"Let it be our secret, eh?" Yueh asked. "Your parents might think it too valuable for a child to have."

And Yueh thought: *His mother would surely wonder at my motives.*

"Well . . ." Paul closed the book, held it in his hand. "If it's so valuable . . ."

"Indulge an old man's whim," Yueh said. And he thought: *I must catch his mind as well as his cupidity.* "Open it to four-sixty-seven Kalima. Where it says: *'From water does all life begin.'* There's a little fingernail notch on the edge of the cover to mark the place."

Paul felt the cover, and his sensitive finger detected two notches, one very shallow. He pressed the shallow one. The book spread open on his palm and its magnifier slid into place.

"Read it aloud," Yueh said.

Paul wet his lips with his tongue, read: " 'Think you of the fact that a deaf person cannot hear. Then, what deafness may we not all possess? What senses do we lack that we cannot *see* and cannot *hear* another world all around us? What is there around us that we cannot . . ."

"Stop it!" Yueh barked. He closed his eyes, fought to regain his composure. *What perversity caused the book to open at my Wanna's favorite passage?* He opened his eyes, saw Paul staring at him. "I'm sorry," Yueh said. "That was my . . . dead wife's favorite passage. It's not what I intended you to read me."

"There are two notches," Paul said.

Of course, Yueh thought. *His fingers are more sensitive than mine. It was an accident, that's all.*

"You will find the book interesting," Yueh said. "Any questions you have, bring them to me."

Paul looked down at the book on his palm—such a tiny thing. Yet something had happened while he read from it; something touched the Terrible Purpose within him.

"Your father will be here soon," Yueh said. "Put the book away and read it at your leisure."

Paul touched the edge as Yueh had shown him. The book sealed itself. He slipped it into his tunic pocket. For a moment there when Yueh had barked at him, Paul had feared the man would demand the return of the book. Paul spoke formally: "I thank you for the gift, Dr. Yueh. It will be our secret. If there is gift or favor you wish from me, please do not hesitate to ask."

"I want nothing," Yueh said.

And he thought: *Why do I stand here torturing myself? And torturing this poor lad, too . . . though he does not yet know it. Oeyh! Those Harkonnen beasts! Why did they choose me for this abomination?*

VI

How do we approach the study of Muad'Dib's father? A man of surprising warmth and equally surprising coldness was the Duke Leto Atreides. Many things open the Way to this Duke: his abiding love for his Bene Gesserit Lady; the dreams he held for his son; the devotion with which men served him. You see him there: a man snared by Destiny, a lonely figure with his light dimmed behind *the glory of his son. Yet, you might ask: What is a son but an extension of the father?*

"Muad'Dib, Family Commentaries"
by The Princess Irulan

Paul watched his father come into the training room, saw the guards taking up station outside before the door was closed. As always, Paul experienced a sense of *presence* in his father, someone totally *here*. The Duke was tall, olive-skinned. His thin face had harsh angles warmed only by deep gray eyes. He wore a black working uniform with red armorial hawk crest at the breast. A silver shield-belt with the patina of much use was fitted tightly around his narrow waist.

The Duke said: "Hard at work, son?" He crossed to the ell table, glanced at the papers on it, swept his gaze around the room and back to Paul. He felt tired, filled with the ache of not showing his fatigue. *I must use every opportunity to rest during the crossing*, he thought. *There'll be no rest on Arrakis.*

"Not working very hard," Paul said. "Everything's so . . ." He shrugged.

"Yes. Well, tomorrow we leave. It'll be good to get settled in our new home, put all this upset behind us."

Paul nodded, suddenly overcome by memory of the old woman's words: "*. . . For the father, nothing.*"

"Father," Paul said, "will it be as dangerous as everyone says?"

The Duke forced himself to the casual gesture, sat down on a corner of the ell table, smiled. A whole pattern of conversation welled up in his mind—the kind of thing he would use to dispel the vapors in his men before a battle. And the pattern froze before it could be vocalized, confronted by the single thought: *This is my son.*

"It will be dangerous," he admitted.

"Hawat says we have a plan for the Fremen," Paul said. And he wondered: *Why don't I tell him what the old woman said? How did she seal my tongue?*

The Duke noted the evidence of his son's distress, said: "As always, Hawat focuses on the main chance. But there is more, much more. Me, I see the Combine Honnete Ober Advancer Mercantiles—the CHOAM Company. By giving us Arrakis, His Majesty gives us a CHOAM directorship. This is a thing that could not be denied us or faked . . . a subtle gain."

"The spice is a CHOAM thing," Paul said. "I know that, but why do . . ."

"Our new avenue into the Company already has enabled us to make sure that the spice has not been artificially produced somewhere, that the price structure will not be destroyed."

"Yueh says the chemistry of the spice defies analysis, that it does not . . . behave . . . that . . . Did the Reverend Mother warn you?" Paul clenched his fists, feeling his palms slippery with perspiration The *effort* it had taken just to ask that question!

"Hawat spoke to me before leaving, Paul. He told me she frightened you with warnings about Arrakis. Don't let a woman's fears cloud your mind. No woman wants her loved ones to go into danger. The hand behind these warnings was that of your mother. Take this as a sign of her love for us."

"Haven't you told mother about the Fremen?"

"Yes, but your mother knows the other facts, too."

"What other facts?"

And the Duke thought: *The truth may be even worse than he imagined. But even dangerous facts can bring confidence if you've been trained to deal with them. And there's one place where nothing's been spared for my son —dealing with dangerous facts.*

"No product really escapes the CHOAM touch," the Duke said. "Logs, donkeys, horses, cows, lumber, dung, sharks whale fur, the art forms of Ecaz the machines of Tupile and Ix and Richessa . . . even our poor pundi rice from Caladan. Anything the Guild has agreed to transport. All these fade, though, before *melange* which is a truly unique substance with real geriatric qualities. Now, consider all the Houses which depend upon CHOAM profits. The list reads like a Landsraad roster. Then consider the enormous proportion of those profits dependent upon a single product—the spice. Now, imagine if you will what could happen if something should reduce spice production.

"Profits would be determined along new lines," Paul said. "Whoever had stockpiles of melange could make a killing. Others would be out in the cold."

The Duke looked at his son, thinking how penetrating, how truly *educated* that observation was. He nodded. "Precisely. And we now know that the Harkonnens have been secretly stockpiling spice for some twenty years."

"They mean the spice production to fail while you get the blame and they get the profit," Paul said.

"For *blame* let us substitute the word *unpopular*," the Duke said. "They intend the Atreides name to become unpopular. That list of the Landsraad Houses, Paul, which presently looks to me for a certain amount of leadership. Think how they'll react if I'm responsible for a reduction in their income. After all, one's own profits come first. The Great Convention be damned! You can't let someone pauperize you!" The Duke smiled grimly. "They'd look the other way no matter *what* was done to me."

"You mean they'll use atomics?"

"Nothing that flagrant," the Duke said. "No *open* defiance of the Great Convention, but . . ."

"We shouldn't go," Paul said. "We should find . . ."

"Paul!" The Duke frowned at his son. "Knowing where the trap is—that's the first step in evading it. This is like single combat, son, just on a larger scale: a feint within a feint within a feint . . . seemingly without end. The task is to unravel it. Knowing that the Harkonnens stockpile melange, we immediately ask another question: Who else is stockpiling the spice? You see? When we answer that, we have a list of our enemies."

"Who?"

"Certain Houses that I had thought friendly to me. We need not consider them for the moment. They pale in the light of one other person—our beloved Padishah Emperor."

Paul tried to swallow in a throat suddenly dry. "Father, couldn't you convene the Landsraad, expose them?"

"Make our enemy aware that we know which hand holds the knife? Paul . . . we *see* the knife now. Who knows where it might be shifted next? All we'd do if we put this before the Landsraad is create a great cloud of confusion. The Emperor would deny it with perfect safety. All we'd gain is a little time. And we couldn't be sure of the source of attack."

"All the Houses would start stockpiling spice," Paul said.

"No help there," the Duke said. "Our enemies have a head start . . . too much of a lead to overcome."

"The Emperor," Paul said. "Not atomics, you say. That leaves only one thing."

"The Sardaukar," the Duke said. "They'll be disguised in Harkonnen livery, but they'll be Sardaukar."

"How can the Fremen help us against Sardaukar?"

"Let us consider Salusa Secundus," the Duke said.

Paul blinked. "The Imperial prison planet? But . . ."

"What if it were more than a prison planet? You know, Paul, there's one question you never hear asked about the Imperial Corps of Sardauker. Everyone seems to take it for granted they're just the Emperor's levies, trained young to be soldier-fanatics. We all know that the Legions of Sardaukar are the real reason a Shaddam bar Corino is Padishah Emperor, and you hear an occasional muttering about the quality of the Emperor's training cadres, but this one question remains."

"We'll be providing our own levies for the Emperor now that you've received royal favor," Paul said. "Perhaps they can study the training and report . . ."

"The question remains," the Duke said. "Where do the Sardaukar come from?"

"But you said yourself the levies of . . ."

"The balance of our civilization, Paul, is *not* Landsraad versus Imperium. It's the military forces of the Landsraad Great Houses versus the Sardauker *and* their supporting levies. *And* their supporting levies, Paul. The Sardaukar remain the Sardaukar."

"What's the prison planet have to do with it?"

"These superb fighting men must come from somewhere," the Duke said. "What planet, what system, produces fighters, any one of whom is a match for ten Landsraad conscripts?"

"Salusa Secundus?"

"We think so."

"But the reports on SS . . . it's a hell world!"

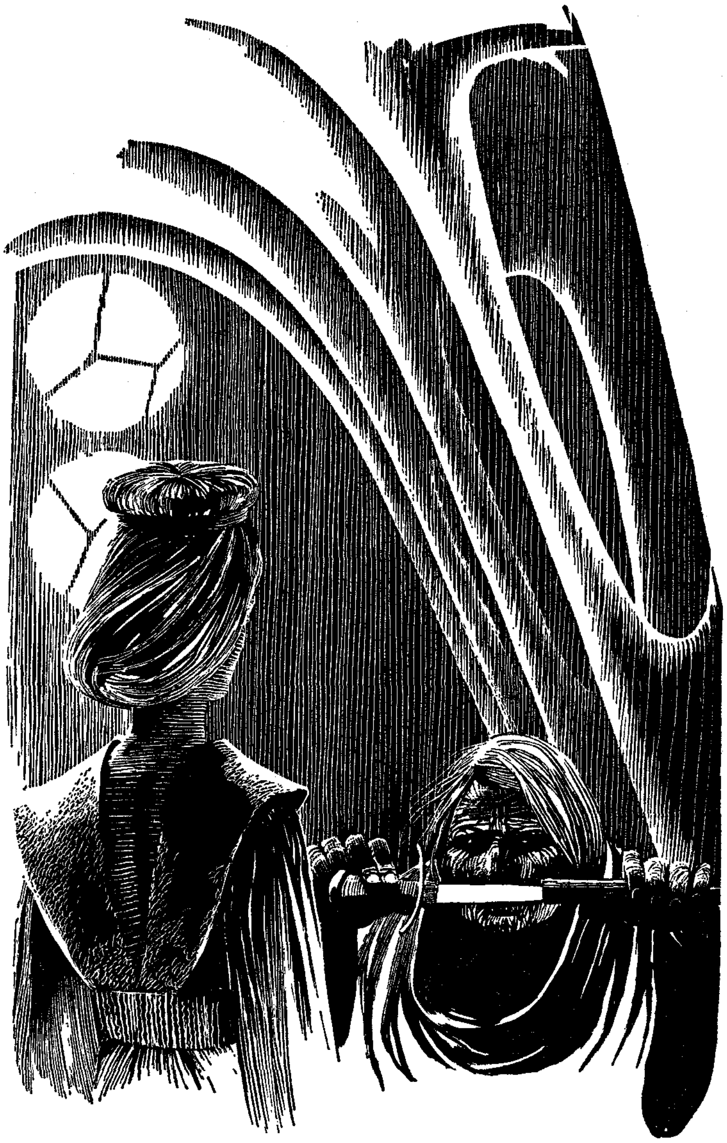
"Undoubtedly. But if you were going to raise tough, strong, ferocious men, what environmental conditions would you impose upon them?"

Paul nodded. "Yes, but how could you get such men to be loyal to you?"

"There are proven ways," the Duke said. "The certain knowledge of your own superiority, the mystique of a secret covenant, these are only a beginning in such loyalty, but they are *facts* which we can apply to the Sardaukar. Now, Paul, mark this and never breathe a word of it to anyone. Not to anyone!"

Paul nodded, holding his attention on his father's face.

"Arrakis, when you get outside the towns and the garrison villages, is a place every bit as terrible as Salusa Secundus."



Paul's eyes went wide. "The Fremen!"

"It may be that we'll have a corps as strong and as deadly as the Sardaukar. But it'll require patience to exploit them secretly, and wealth to equip them properly. The Fremen are there . . . the spice is there. You see now why we walk into Arrakis, knowing it is a trap?"

"Don't the Harkonnens know about the Fremen?"

"The Harkonnens sneered at the Fremen, never bothered even to try counting them. The Harkonnen policy with planetary populations is to spend as little as possible maintaining them."

Paul looked at the hawk symbol over his father's breast. The metallic threads glistened as the Duke shifted his position. "And we have a mission negotiating with the Fremen now," Paul said.

"I sent Duncan Idaho," the Duke said. "A proud and ruthless man, but fond of the truth. I think the Fremen will admire him. If we're lucky, they may judge us by him: Duncan, the moral."

"Duncan, the moral," Paul said, "and Gurney the valorous."

"You call them well," the Duke said.

And Paul thought: *Gurney's one of those the old woman meant—". . . The valor of the brave." Gurney's a supporter of worlds.*

"Gurney tells me you did well in weapons today," the Duke said.

"That isn't what he told me."

The Duke threw his head back, laughed aloud. "I figured Gurney to be sparse with his praise. He says you have a nice awareness of the difference between a blade's edge and tip."

"Gurney says there's no artistry in killing a man with the tip, that it should be done with the edge."

"Gurney's a romantic," the Duke said. The talk of killing disturbed him coming from his son.

"But you can slash with the tip or stab with the edge," Paul said. "The thrust is . . ."

"I'd sooner you never had to kill," the Duke growled, "but if the need arises, you do it however you can—tip or edge." He looked up at the skylight drumming with rain. "Effective decisions are rarely difficult if you have all the facts and recognize your own necessities."

Seeing the direction of his father's stare, Paul thought of the wet skies out there, something never to be seen on Arrakis, and this took his thoughts into space. "Are the Guild ships really big?" he asked.

The Duke looked at him. "This *will* be your first time off planet," the Duke said. "Yes, their ships are big. We'll be riding a Guild Heighliner because Arrakis is almost directly across the galaxy from Caladan. A Heighliner's hold will swallow our frigates and transports and tuck them into a little corner. And if it's loaded, well, you'll see a wonderful collection of cargo: there'll be other frigates and transports, cargo lighters, pickup satellites, jumpdump boxes, yachts, freight gliders. Movement of Atreides freight will be only a small part of the ship's manifest."

"But we won't be able to leave our frigates?"

"No, but that's just part of the price we pay for Guild security. There could be Harkonnen ships right alongside us, and we'd have nothing to fear from them. The Harkonnens know better than to endanger their shipping privileges."

"I'm going to watch the screens carefully and try to see a Guildsman."

"You won't. Not even their agents ever see a Guildsman. Don't endanger our shipping privileges, Paul. The Guild's as jealous of its privacy as it is of its monopoly."

"Do you think it's because they've mutated and don't look . . . *human* any more?"

"Who knows?" The Duke shrugged. "What does Hawat say?"

"All he'll give is a second-order approximation. He's just not sure. It's possible, he says, because the Guild dates from times when radiation shielding was pretty poor. All he said he was sure of is that they're not using mechanical brains as some say they are. He said any Mentat knows the Guild's history—they were leaders in the Jihad—and besides no machine has ever approached the human brain's abilities."

"Instantaneous computation," the Duke mused. "The human mind can operate outside of Time." He put a hand on his son's shoulder. "Well, it's a great mystery but not one we're likely to solve. We've more immediate problems, among them: you."

"Me?"

"It's the real reason I came up here today, son. Your mother wanted me to be the one to tell you. You see, you may have Mentat capabilities, son."

Paul stared at his father, unable to speak for a moment, then: "Me? But I . . ."

"Hawat agrees," the Duke said.

"But I thought Mentat training had to start during infancy, and the subject couldn't be told because it might inhibit the early . . ." He broke off.

"And then this day comes," the Duke said, "when the potential Mentat must be informed of what's being done. The Mentat has to share in the choice of whether to continue the training or abandon it. Some can continue the training to its full flowering; some are incapable of this. Only the potential Mentat can tell this for sure about himself."

Paul blinked. All the special training from Hawat and his mother—the mnemonics, the focusing of awareness, the muscle control and sharpening of sensitivities, the study of languages and nuances of voices—all of it clicked into a new kind of understanding in his mind.

"You'll be the Duke some day, son," the Duke said. "A Mentat Duke would be formidable indeed. Can you decide now, or do you wish more time?"

There was no hesitation in his answer. "I'll continue the training."

"Formidable indeed," the Duke murmured, and Paul saw the proud smile on his father's face. The smile shocked Paul. It had a skull look to it. He closed his eyes, feeling an awakening of the Terrible Purpose within himself. *Perhaps being a Mentat is Terrible Purpose,* he thought.

But even as he had this thought, his new awarness denied it.

VII

With the Lady Jessica and Arrakis, the Bene Gesserit system of broadcasting implanted legends *through the Missionaria Protectiva came to its full fruition. The wisdom of seeding the universe with patterned prophecy for protection of BG personnel has long been recognized, but never have we seen a* condition ut extremis *with more ideal mating of person and preparation. The prophetic legends had* taken *on Arrakis even to the extent of adopted labels—including Reverend Mother, canto and respondu, and most of the shari's* panoplia propheticus. *And it is generally accepted now that the Lady Jessica's latent abilities were grossly underestimated.*

"Analysis: The Arrakeen Crisis"
by The Princess Irulan
(private circulation: BG file number AR-81088587)

All around the Lady Jessica—piled in corners of the Arrakeen great hall, mounded in the open spaces—stood the packaged freight of their lives: boxes, trunks, cartons, cases—some partly unpacked. She could hear the cargo handlers from the shuttle depositing another load in the entry.

Jessica stood in the center of the hall. She moved in a slow turn, looking up and around at shadowed carvings, crannies and deeply recessed windows. This giant anachronism of a room reminded her in a way of the Sisters' Hall at her Bene Gesserit school. But at the school the effect had been of warmth. Here, all was bleak stone coldness.

Some architect had reached far back into history for these buttressed walls and dark hangings, she thought. The arched ceiling stood two stories above her with great cross beams that she felt sure must have been shipped here to Arrakis across space and at monstrous cost. No planet of this system grew trees to make such beams . . . unless the beams were imitation.

She thought not.

This had been the Arrakis Government mansion in the days of the Old Empire. Costs had been of lesser importance then. It had been before the coming of the Harkonnens and their new city of Carthag, a cheap and brassy place some two hundred kilometers northeast across the Broken Land. Leto had been wise to choose this place for his seat of government. The name, Arrakeen, had a good sound, filled with tradition. And this smaller city would be easier to sterilize and defend.

Again, there came the clatter of boxes being unloaded in the entry. Jessica sighed.

Against the wall to her right stood the painting of the Duke's father. Wrapping twine hung from it like a frayed decoration. A piece of the twine was still clutched in Jessica's left hand. Beside the painting lay a black bull's head mounted on a polished shield board. The head was a dark island in a sea of wadded paper. Its mounting plaque lay flat on the floor, and the bull's shiny muzzle pointed at the ceiling as though it were ready to bellow a challenge into this echoing room.

Jessica wondered what compulsion had brought her to uncover those two things first—the head and the painting. There was something symbolic in the action, she knew. Not since the day when the Duke's buyers had taken her from the school had she felt this frightened and unsure of herself. The head and the picture only heightened her feelings of confusion. She shuddered, glanced up at the slit windows.

It was still early afternoon, and in these high latitudes the sky looked black and cold, so much darker than the warm blue of Caladan. A pang of homesickness sobbed through her.

So far away, Caladan.

"Here we are!"

The voice was Duke Leto's. She whirled as he strode through the arched passage from the dining hall. His black working uniform with red armorial hawk crest at the breast looked dusty and rumpled.

"I thought you might have lost yourself in this hideous place," he said.

"It is a cold house," she said. She looked at his tallness, at the dark skin that made her think of olive groves and golden sun on blue waters. There was woodsmoke in the gray of his eyes, but the face was predatory: thin, full of sharp angles and planes.

A sudden fear of him tightened her breast. He had become such a savage, driving person since the decision to bow to the Padishah Emperor's command.

"The whole city feels cold," she said.

"It's a dirty, dusty little garrison town," he agreed. "But we'll change that." He looked around the hall. "These are public rooms for state occasions. I've just glanced at some of the family apartments in the south wing. They're much nicer." He stepped closer, touched her arm, admiring her stateliness.

And again, he wondered at her unknown ancestry—a renegade House, perhaps, or some black-barred royalty? *She looks more regal than the Emperor's own blood,* he thought.

She turned half away under the pressure of his stare.

And he realized that there was no single and precise thing that brought her beauty to focus. The face was oval under a cap of hair the color of polished bronze. Her eyes were set wide, as green and clear as the morning skies of Caladan. The nose was small, the mouth wide and generous. Her figure was good but . . . scant—tall and with its curves gone to slimness.

He remembered that the lay sisters at the school had called her skinny, so his buyers had told him, but that description oversimplified. She had brought a regal beauty back into the Atreides line. He was glad that Paul favored her.

"Where's Paul?" he asked.

"Some place around the house taking his lessons with Yueh."

"They're probably in the south wing," he said. "I heard Yueh's voice, but I couldn't take the time to look." He looked down, hesitating. "I came in only to hang the key to Caladan Castle in the dining hall."

She caught her breath, stopped the impulse to reach out to him. This was not the time or place for comforting. "I saw our banner over the house as we came in," she said.

"But there're traces of the Imperial Yellow all around," he said. "I want it all removed." And as he saw her staring at him: "It's our right!"

"Of course," she said, and seeking to turn the conversation: "I've told Yueh not to let up on Paul's lessons. I'll not have him turning into a barbarian simply because we're forced to live on a barbarian planet."

A chill smile touched the Duke's mouth. "At such moments as this I often congratulate myself that I chose you for Paul's mother."

She flushed, thinking: *How little he knows of that choice.*

He glanced at the painting of his father. "Where were you going to hang that?"

"Somewhere in here."

"No." The word rang flat and final, telling her that she could use trickery to persuade, but that it was useless to argue. Still, she had to try, even if the gesture served only to remind herself that she would not trick him.

"My Lord," she said, "if you'd only . . ."

"The answer remains no. I indulge you shamefully in most things. Not in this. I've just come from the dining hall where there . . ."

"My Lord! Please!"

"The choice is between your digestion and my ancestral dignity, my dear. There are appropriate positions in the dining hall for both painting and bull's head."

She sighed. "Yes, My Lord."

"If you wish to resume your custom of dining in your rooms whenever possible, you may. I shall expect you at your proper position only on formal occasions."

"Thank you, My Lord."

"And don't go all cold and formal on me," he said. "Be thankful that I never married you, my dear. Then it would be your *duty* to join me at table for every meal."

She held her face immobile, nodded.

"Hawat already has our own poison snooper over the dining table," he said. "There's a portable in your room."

"You anticipated this . . . disagreement," she said.

"I think also of your comfort," he said. "I've engaged servants. They're locals, but Hawat has cleared them. They'll do until our own people can be released from their other duties.

"Can anyone from this place be truly safe?" she asked.

"Anyone who hates Harkonnens," he said. "You may want to keep the housekeeper. She's known as the Shadout Mapes."

"Shadout," Jessica said. "A title?"

"I'm told it means 'well-dipper', a meaning with rather important overtones here. She will not strike you as a servant type, although Hawat speaks highly of her, and I'm convinced she truly wishes to serve. Specifically, she wishes to serve you."

"Me?"

"They've learned that you're Bene Gesserit," he said. "There are legends here about Bene Gesserit."

The Missionaria Protectiva, Jessica thought. *No place escapes them.*

"The Shadout Mapes is a Fremen," he said.

The implications of this commanded her complete attention. "Then Duncan was successful? The Fremen will be our allies?"

"There's nothing definite," he said. "They wish to observe for a while. However, they did promise to stop raiding the outlying villages. We have a truce of sorts. And that's a more important gain than it might seem. Hawat tells me the Fremen were a deep thorn in the Harkonnen side, that the extent of their ravages was a carefully guarded secret. It would not have helped for the Padishah Emperor to learn the ineffectiveness of the Harkonnen military."

"She will have the blue eyes, then," Jessica said, returning her attention to the subject of the Shadout Mapes.

"That's going to take a little getting used to," he said. "All these eyes without any whites in them . . . very dark and mysterious."

"Yueh inclines to the theory of spice diet," she said. "I give that my own qualified agreement, although there may be some genetic influence."

"We'll have plenty of time to investigate it," he said. "One thing: don't let the appearance of these people deceive you. There's deep strength and a healthy animal vitality in them. I think they'll be everything we want."

"It's a dangerous gamble," she said.

"Let's not go into that again," he said.

She forced a smile. "We *are* committed, no doubt of that." She went through the quick regimen of calming—the two deep breaths, the ritual thought, then: "When I look over the south wing to assign rooms, is there anything special I should reserve for you?"

"You must teach me some day how you do that," he said, "the way you thrust aside your worries and turn to practical matters. It must be a Bene Gesserit thing. Well, assignment of rooms: Make certain that I have large office space next my sleeping quarters. A guard room, of course. Don't worry about any part of this house being safe. Hawat's men have been over it in depth."

"I'm sure they have."

He glanced at his wrist watch. "And you might see that all our timepieces are adjusted for Arrakeen time. I've assigned a technician to take care of it. He'll be along presently." He brushed a strand of her bronze hair back from her forehead. "I must return to the landing field now. The second shuttle's due any minute with my staff."

"Couldn't Hawat meet them, My Lord? You look so tired."

"The good Thufir is even busier than I am," he said. "You know there's no place on this planet that escaped Harkonnen intrigues. Besides, I must try persuading some of the trained spice hunters against leaving. They have the option, you know, with the change of fief. About eight hundred expect to go out on the spice shuttle and there's a Guild cargo ship standing by."

"My Lord . . ." She broke off, hesitating.

"Yes?"

He will not be persuaded against trying to make this planet secure for us, she thought. *And I cannot use my tricks on him.*

"At what time will you be expecting dinner?" she asked.

That's not what she was going to say, he thought. *Ahh, my Jessica, would that we were somewhere, anywhere away from this terrible place—alone, the two of us, without a care.*

"I'll eat in the officers' mess at the field," he said. "Don't expect me until very late. And . . . ah, I'll be sending a guardcar for Paul. I want him to attend our strategy conference."

He cleared his throat as though to say something else, and without warning, turned and strode out through the entry. She heard his voice there, commanding and disdainful, the way he always spoke to servants when he was in a hurry: "The Lady Jessica is in the Great Hall. Join her there immediately." The outer door slammed.

Turning away, Jessica faced the painting of Leto's father. It had been done by the famed artist, Albe, during the Old Duke's middle years. The Old Duke was portrayed in matador costume with a magenta cape flung over his left arm. The face looked young, little older than Leto's now, and with the same hawk features, the same gray stare. She clenched her fists at her sides, glared at the painting.

"Damn you! Damn you! Damn you!" she whispered.

"What are your orders, noble born?"

It was a woman's voice, thin and stringy.

Jessica whirled, stared down at a knobby gray-haired woman in a shapeless sack dress of bondsman brown. The woman was as wrinkled and dessicated looking as any member of the mob that had greeted them along the way from the landing field. Jessica thought that every native she had seen on this planet looked prune dried and undernourished, yet Leto had said they were strong and healthy. And then there were the eyes, of course, that wash of the deepest, darkest blue—looking secretive and withdrawn. Jessica forced herself not to stare at them.

The woman gave a stiff-necked nod, said: "I am called the Shadout Mapes, noble born. What are your orders?"

"You may refer to me as *My Lady,*" Jessica said. "I am not noble born. I am the bound concubine of the Duke Leto."

Again, that strange nod, and the woman peered at Jessica with a sly questioning. "There is a wife?"

"There is not, nor has there ever been. I am the Duke's only . . . companion, the mother of his heir designate."

And even as she spoke, Jessica laughed inwardly at the pride behind her words. *What was it St. Augustine said? "The mind commands the body and it obeys. The mind orders itself and meets resistance." Yes,* she thought, *I am meeting more resistance lately. I could use a quiet retreat by myself.*

A weird cry sounded from the road outside the house. It was repeated: "Soo-soo-Souk! Soo-soo-Souk!" Then: "Ikhut-Eigh! Ikhut-Eigh!" And again: "Soo-soo-Souk!"

"What *is* that?" Jessica asked. "I kept hearing it as we drove through the streets from the field."

"Only a water-seller, My Lady. But you've no need to interest yourself in such as they. The cistern here holds fifty thousand liters and it's always kept full." She glanced down at her dress. "Why, you know, My Lady, I don't even have to wear my stillsuit here and I've even had a bath!" She cackled. "And me not even dead!"

Jessica hesitated, wanting to question this woman, needing data to guide her, but bringing order out of the mess in this castle was more imperative. Yet, the thought that water itself was a major mark of wealth here she found unsettling.

"What do I call you, Shadout Mapes?" Jessica asked.

"The Shadout is just a Fremen title," she said. "It means 'Well-Dipper.' You may call me Mapes, My Lady."

"My husband told me of your title and then I recognized the word," Jessica said. "It's a very ancient word."

"You know the ancient tongues, then?" Mapes asked, and she waited with an odd intentness on the answer.

"Many times many ancient tongues," Jessica said. "For the Bene Gesserit, tongues are among the First Learnings."

Mapes nodded knowingly. "It is true, then, just as the legend says."

And Jessica wondered: *Why do I play out this part, knowing the sham in it? But the Bene Gesserit ways are devious and compelling.*

"And I know the Dark Things and the ways of the Great Mother," Jessica said. She read the more obvious signs on Mapes' actions, the tiny betrayals. "I know that you have born children, that you have lost loved ones, that you have hidden in fear and that you have done violence. And I know much more than this."

Mapes took a backward step, appeared poised to flee. In a low voice, she said: "I meant no offense, My Lady."

"You meant only to seek answers, and you were prepared for violence should the questioning go wrong," Jessica said. "You carry a weapon in your bodice."

"My Lady, I . . ."

"There is a remote possibility that you could draw my life's blood," Jessica said, "but in so doing you would encompass your own ruin. There are worse things than dying, you know."

Mapes appeared about to fall to her knees. "My Lady, the weapon was sent as a gift to you should you prove to be the One."

"And as the means of my death should I prove otherwise," Jessica said. And she waited in the seeming relaxation that made the Bene Gesserit-trained so terrifying in combat. This exchange with the Fremen female betrayed deep possibilities, but the decision had not yet tipped one way or the other.

Slowly, Mapes reached into the neck of her dress, brought out a dark sheath, a black handle with finger ridges protruding from it. She took the sheath in one hand, the handle in the other, withdrew a milk white blade that seemed to shine and glitter with a light of its own. It was double-edged like a *kindjal* and the blade perhaps twenty centimeters long.

"Do you know what this is, My Lady?" Mapes asked.

It could only be one thing, Jessica knew, the fabled *crysknife* of Arrakis. "It's a crysknife," she said.

"Say it not casually," Mapes said. "Do you know the meaning of it?"

And Jessica thought: *There was an edge to that question. This is the answer that could precipitate violence or . . . what? She seeks an answer from me—the* meaning *of a knife. She is called the Shadout. In that old tongue a knife was known as Death Maker. I must answer now. Delay, too, is dangerous.* She said: "It is a maker . . ."

"Eigheeeeee!" Mapes wailed. It was a sound like both grief and elation. She was trembling.

Jessica waited. She had intended to say the knife was a maker of death and then use the ancient word, but every sense warned her now, all the deep training for alertness that exposed a meaning in the most casual muscle twitch.

The key word was *maker. Maker? Maker.*

Still, Mapes held the knife as though ready to use it.

Jessica said: "Did you think that I, knowing the mysteries of the Great Mother, would not know of the Maker?"

Mapes lowered her eyes. "My Lady, when one has lived with prophecy for so long, the moment of revelation is like a shock."

And Jessica thought about the prophecy: A Bene Gesserit Reverend Mother of the Missionaria Protectiva, dropped here long centuries ago with but one purpose—to implant the protective legends, preparing for a need that might never arise. Yet, it had arisen.

Jessica, too, experienced some of that same feeling of shock at this meeting between the need and the preparation.

Mapes returned the knife to its sheath, said: "How may I give this blade to you, My Lady?"

The answer was obvious. "Never to take it back while I live," Jessica said, and she risked a gamble of words: "Mapes, you've let emotion betray you. You've sheathed that knife unblooded."

With a gasp, Mapes dropped the sheathed knife, tore open her bodice. "Take the water of my life," she wailed.

Jessica stooped, picked up the sheathed blade, withdrew it. How it glittered! She directed the point toward Mapes, saw a fear in the woman's manner that was greater than death-panic.

Something special about the crysknife point. A poisoned well in it, perhaps.

Jessica tipped the knife up, drew a delicate scratch mark with the blade's edge above Mapes' left breast. There was a thin welling of thick blood that stopped almost immediately.

Sheathing the knife, Jessica said: "Your life is mine, Mapes. Now button your dress."

Mapes obeyed, trembling, those eyes-without-whites staring at Jessica. "And you are ours," she muttered.

There came another sound of unloading in the entry.

Swiftly, Mapes grabbed the sheathed crysknife from Jessica, concealed it in Jessica's bodice. "Who sees that blade may not leave Arrakis alive!" she snarled. "You *know* that, My Lady!"

I know it now, Jessica thought. *And that's what she meant when she said I'm theirs.*

The cargo handlers left without intruding on the great hall.

Mapes composed herself, said: "The thing must take its course. We cannot hurry it." She glanced at stacked boxes and piles of goods around them. "And there's work aplenty for us here."

Jessica hesitated. '*The thing must take its course.*' That referred to a specific one of the Missionaria Protectiva's stock of incantations—*The Coming of The Reverend Mother To Free You.*

But I'm not a Reverend Mother, Jessica thought. And then: *Great Mother! They planted* that *one here! This must be a hideous place!*

In a matter of fact tone, Mapes said: "What'll you be wanting me to do first . . . My Lady?"

Instinct told Jessica to match that casual tone. She said: "This painting here must be hung on one side of the dining hall and the head goes on the wall across from the painting."

Mapes crossed to the bull's head. "What a great beast it must have been to carry such a head." She stopped. "But I'll have to be cleaning this first, won't I, My Lady?"

"No."

"But there's dirt caked on its horns."

"That's not dirt, Mapes. That's the blood of the Duke's father. The horns were sprayed with a transparent fixitive within hours after this beast killed the Old Duke."

Mapes stood up. "Ah, now!" she said.

"It's just blood," Jessica said. "Old blood at that. Get some help hanging these now. The beastly things are heavy."

"Did you think the blood bothered me?" Mapes asked. "I'm of the desert and I've seen blood aplenty."

"Yes . . . I see that you have," Jessica said.

"And some of it my own," Mapes said. "More'n you drew with your puny scratch."

"You'd rather I'd cut deeper?" Jessica asked.

"Ah, no! The body's water is scant enough without gushing a wasteful lot of it out into the air. You did the thing right."

And Jessica, noting the words and the manner, caught the deeper implications in the phrase '*the body's water*' and again she felt a sense of oppression at the importance of water on this planet.

"On which side of the dining hall shall I hang which one of these things, My Lady?" Mapes asked.

Ever the practical one, Jessica thought. She said: "Use your own judgment. It makes no real difference."

"As you say, My Lady." Mapes stooped, began clearing the rest of the wrappings and twine from the bull's head. "Killed an old duke, did you?" she crooned.

Different lands, different customs, Jessica told herself. She said: "Shall I summon a handler to help you hang these?"

"No, My Lady. I'll manage."

And Jessica thought: *Yes, she'll manage. There's that about her—the drive to accomplish.* Jessica could feel the cold sheath of the crysknife beneath her bodice, and she thought of the long chain of Bene Gesserit accomplishments that had forged another link here. *A crisis passed in the first hours on Arrakis.*

Mapes had said: "*We cannot hurry it.*" Yet there was a tempo of rushing ahead to this place that filled Jessica with foreboding, and not all the preparations of the Missionaria Protectiva nor Hawat's suspicious inspection of this castellated pile of rocks could dispel the feeling.

"When you've finished hanging these," Jessica said, "you may start unpacking the boxes. One of the cargo men at the entry has all the keys and knows where things should go. Get the list from him. If there are any questions, I'll be in the south wing."

"As you will, My Lady," Mapes said.

Jessica turned away. *Hawat may have passed this place as safe, but there's something wrong about it,* she thought. *I can feel it.* An urgent need to see her son gripped her. She began walking toward the arched doorway that led into the corbelled passage to the dining hall and the family wings beyond. Faster and faster she walked until she was all but running.

Behind her, Mapes paused in clearing the wrappings from the bull's head, looked at the retreating back. "She's the One all right," she muttered. "Poor thing."

VIII

"Yueh! Yueh! Yueh!" goes the refrain. "A million deaths were not enough for Yueh!"

"A Child's History of Muad'Dib"
by The Princess Irulan

The door was ajar, and Jessica stepped through into a room with yellow walls. To her left stretched a low settee of black hide and two empty bookcases, a hanging waterflask. On her right, bracketing another door, stood more empty bookcases, a desk and three chairs. At windows directly across from her stood Dr. Yueh, his back to her and intent upon the outside world.

Jessica took another silent step into the room.

She saw that Yueh's coat was wrinkled, a white smudge streaking it near the left elbow as though he had leaned against chalk. From behind, he looked the fleshless stick figure concealed in overlarge black clothing, a caricature poised for stringy movement at the direction of some puppet master. Only the squarish block of his head with the long ebony hair caught in its silver ring at the shoulder seemed alive.

She glanced around the room, saw no sign of her son, but the closed door on her right, she knew, led into a small bedroom for which Paul had expressed a liking.

"Good afternoon, Dr. Yueh," she said. "Where's Paul?"

He nodded as though to something out the window, spoke in an absent manner without turning: "Your son grew tired, Jessica. I sent him into the next room to rest."

Abruptly, he stiffened, whirled with mustache flopping over his purplish lips. "Forgive me, My Lady! My thoughts were far away . . . I . . . did not mean to be familiar."

She smiled, held out her hand. For a moment, she was afraid he might kneel. "*Wellington,* please."

"To use your name like that . . . I . . ."

"We've known each other for six years," she said. "It's long past time when formalities should have been dropped between us . . . in private, that is."

Dr. Yueh ventured a smile, thinking: *I believe it has worked. Now, she will think anything unusual in my actions is due to embarrassment. She will not look for deeper reasons when she believes she already has the right answer.*

"I'm afraid I was woolgathering," he said. "Whenever I feel especially sorry for you, I find myself thinking of you as . . . well, Jessica."

"Sorry for me? Whatever for?"

Dr. Yueh shrugged. Long ago, he had realized Jessica was not gifted with the full *truthsay* as his Wanna had been. Still, he always used the truth with Jessica whenever possible.

"You've seen this place, My . . . Jessica." He stumbled over the name, plunged on: "It's so barren after Caladan. And the people! Those townswomen we passed on the way in wailing beneath their veils! The way they look at us."

She folded her arms across her breasts, hugging herself. "It's just that we're strange to them—different people, different customs." And she felt the crysknife pressed against her beneath her arms. "What were you looking at out there?"

"The people." He turned back to the window.

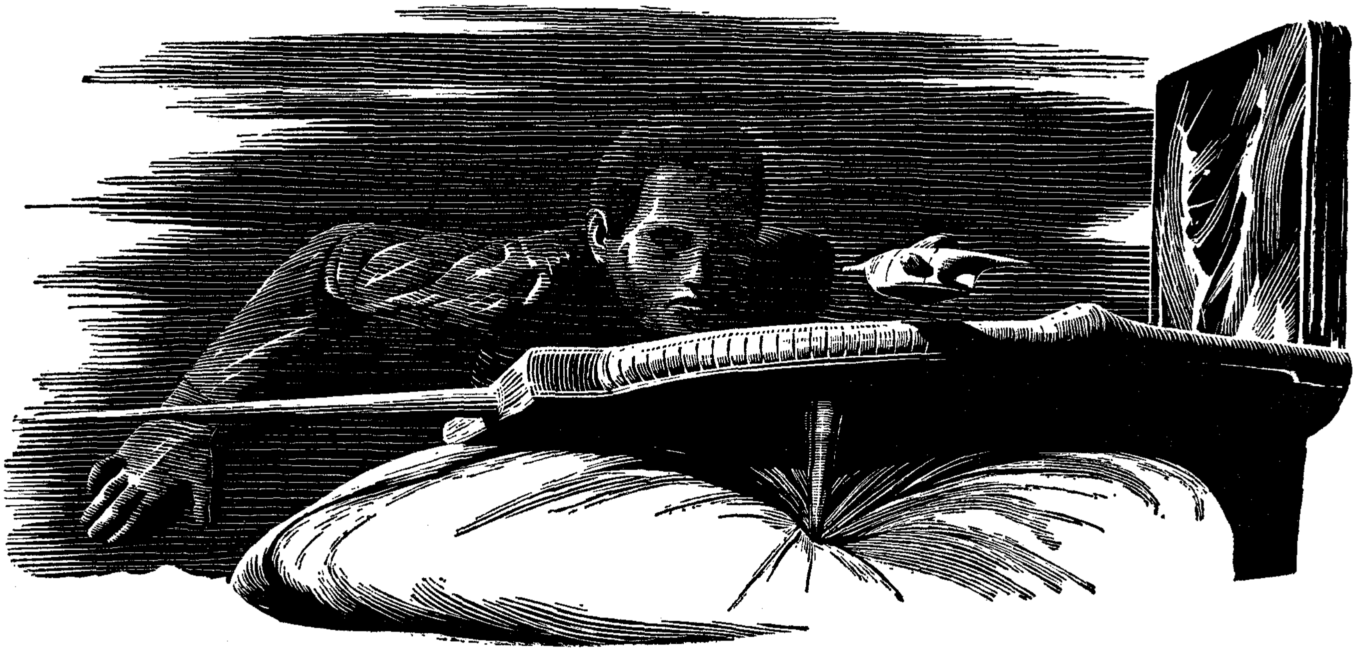
Jessica crossed to stand beside him, looking to the left toward the front of the house where Yueh's attention had been focused. A line of twenty palm trees had been planted there. The ground beneath them was barren, swept clean. A screen fence separated them from the road upon which people were passing. Jessica's acute senses detected a faint shimmering between her and the people—a house shield, naturally—and went on to study that passing throng, wondering why Yueh had found them so absorbing.

The pattern emerged quickly. It was the way they looked at the palm trees. There was envy in the stares certainly, and even some hate, but she was sure she detected a sense of hope in them, too.

"Do you know what they are thinking?" Dr. Yueh asked.

"You profess to read minds?" she asked lightly.

"Those minds," he said. "They look at those trees and they think: '*There are one hundred of us.*' That's what they think."



"What?" She looked at Dr. Yueh, puzzled.

"Those are date palms," he said. "One date palm needs forty liters of water a day. A man requires but eight liters. A palm tree, then, equals five men, and there are twenty palms out there—one hundred men."

"But some of them look at those trees hopefully."

"They but hope some dates will fall to them, except it's the wrong season."

"We look at this place with too critical an eye," she said. "No doubt it's everything we fear, yet there's hope in it, too. The spice *could* make us rich. With a fat treasury, we could make this world into whatever we wished."

And she laughed silently at herself: *Who am I trying to convince?* The laugh broke through her restraint and came out brittle, empty of humor. "But you cannot buy security."

Dr. Yueh hid his face from her by turning away. *If only it were possible to hate these people instead of love them,* he thought. In her mannerisms, in many ways, Jessica was like his Wanna. Yet, that thought carried its own rigor, hardening him to purpose. The ways of the Harkonnen cruelty were devious. Wanna might not be dead, but he had to be certain.

"Do not worry for us, Wellington," she said. "The problem is not yours to solve."

She thinks I worry for her! He blinked back tears. *And I do, of course. But I must stand before the Baron with the deed accomplished, and take my only chance to strike him where he is weakest.*

He sighed.

"I'd like to look in on Paul," she said. "Do you think it would disturb him?"

"Not at all. I gave him a sedative. He was overexcited."

"He's taking the change well, though," she said.

"Except for getting overtired, I fear," Dr. Yueh said. "He's excited, but what fifteen-year-old wouldn't be? He wants to be outside doing the things any normal boy his age would want to be doing: testing this new air, looking at the strangeness, talking to different people." He crossed to the closed door, opened it. "He's in here."

She followed, peered into the other room.

Paul lay on a narrow cot, one arm under a light cover, the other arm thrown back over his head. Slatted blinds on a window beside the bed wove a loom of shadows across face and blanket.

Jessica stared at her son's face, seeing the oval shape of it so like her own. But the hair was the Duke's—coal-colored and tousled. Long lashes concealed the lime-toned eyes. Jessica smiled, feeling her fears retreat a ways. She was suddenly caught by the idea of the genetic traces in her son's features. There were her lines in eyes and facial outline, but with sharp touches of the father peering through the outline like maturity emerging from childhood.

And she thought of the boy's features as an exquisite distillation out of random patterns. She pictured endless queues of happenstance meeting at this nexus. The thought made her want to kneel beside the cot and take her son in her arms, but she was inhibited by the presence of Dr. Yueh. She stepped back, closed the door.

Dr. Yueh had returned to the window, unable to bear watching the way Jessica stared at her son. *Why did Wanna never give me children?* he asked himself. *There was no physical reason against it. Was there some Bene Gesserit reason? Was she, perhaps, instructed to serve a different purpose?*

For the first time, he was caught up in the thought that he might be part of a pattern more involuted and devious than his mind could grasp.

Jessica stopped beside him. "What delicious abandon in the sleep of a child," she said.

He spoke mechanically: "If only adults could relax like that."

"Yes."

"Where do we lose it?" he murmured.

She glanced at him, catching the odd tone, but her mind was still on Paul, thinking of the new rigors in his training, thinking of the differences in the life facing him here . . . so very different from the life they had once planned for him.

"We do, indeed, lose something," she said.

Jessica looked out to the right at a slope humped with wind-troubled gray-green bushes—dusty leaves and dry claw branches. The too-dark sky hung over the slope like a blot, and the milky light from the sun Arrakis gave the scene a silver cast—a light like that from the crysknife concealed in her bodice.

"The sky's so dark," she said.

"That's partly the lack of moisture," he said. "Arrakis is a tremendous planetological mystery. There's a theory that Arrakis experienced very little burning of oxygen and hydrogen during its formation—thus, the scarcity of water. Yet some regions abound in volcanic rock."

"You think there's really water here, or that we won't know the real reason why there is so little?"

"I think there is water," he said, and he thought: *Yes. Let us talk about something interesting. Let us talk about something that will leave no room for suspicions.*

"Then where is it?" she asked. "I've read the reports put out by the Imperial Commission. There's water locked in polar ice, of course—but the cost of it! Where else would there be water we could get? You can't drill in the desert, they say. Storms and sandtides destroy the equipment faster than it can be installed . . . and they've never found water traces there, anyway. The wells they've drilled up here in the sinks and basins produced a few trickles of water, then dried up."

He heard her out, watching the way her attention focused down on the problem with a squinting of eyes and that poised relaxation of jaw muscles before each word.

"There are two unexplained facts," he said. "Some of the wells produced a few trickles of water that dried up quickly. There is water down there, then. Yet, it never again collects in a well that has dried. Why? The water was there and was pumped out in a small amount. It dried up? All right. Why has no water collected in these wells after the pumps stopped? Why? Has no one ever been curious about this?"

"I . . ." Jessica stared at him. "You suspect some living agency that seals off the water? Wouldn't it have shown in the core samples?"

"What would have shown? Would alien plant matter be recognizable?"

"Plant matter?"

"Or animal matter? Or some other as yet unrecognized agency? The water is stopped. This is the thing I see. What puts the plug in it?"

"Perhaps the reason is known," she said. "The Harkonnens sealed off many sources of information about Arrakis. Perhaps there was a reason to suppress this."

"Then, what of the atmospheric moisture?" he asked. "There is a certain amount of water vapor in the air. It's the major source of water, caught in the windtraps and the precipitators. Where does that come from?"

"The ice caps."

"Perhaps, but I think me it would not account for all the moisture. Cold air takes up little moisture. No. There are things here behind the *Harkonnen* veil that will bear investigating, and not all of these things are directly involved with the spice."

He broke off, noting the different way she was studying him. "Is something wrong, My . . . Jessica?"

"The way you said *Harkonnen*," she said. "My Duke's voice does not carry that weight of venom when he says the hated name. I did not know you had personal reason to hate the Harkonnens, Wellington."

Great Mother! I've aroused her suspicions! he thought. *Now I must use every trick my Wanna taught me. Only one thing to do is use the truth as far as I can.*

He said: "You know that my Wanna . . ." He shrugged, unable to speak past the constriction in his throat. Then: "They . . ." The words would not come out. He clenched his eyes closed, feeling the agony in his breast and little else until a hand touched his arm gently.

"Wellington," she said, "forgive me. I did not mean to open an old wound." And she thought: *Those animals! His wife was Bene Gesserit, and it's obvious the Harkonnens killed her. This must be why Hawat trusts Yueh so much. We're bound together by a* cherem *of hate.*

"I'm sorry that I'm unable to talk about it," he said. He opened his eyes, giving himself up to the internal awareness of grief. That, at least, was truth.

Jessica studied him, seeing the up-angled cheeks, the dark sequins of almond eyes, the butter complexion and the stringy mustache that hung like a curved frame around the thin purplish lips and narrow pointed chin. The deep creases of his cheeks and forehead, she saw, were lines of sorrow as much as age. A deep affection for him came over her.

"I'm sorry we brought you into this dangerous place," she said.

"I came willingly," he said. And that, too, was true.

"But this whole planet is a Harkonnen trap," she said.

"It will take more than a trap to catch the Duke Leto," he said. And that, too, was true.

"Yes." She nodded, looked again out the window at the alien hillside. "Perhaps I don't have enough confidence in him. I should, I know. He's a brilliant tactician."

"It's only natural to feel uneasy at a change such as this one," he said. "We've been uprooted."

"And how easy it is to kill an uprooted plant," she said. "Especially if you put it down in hostile soil."

"Do we know that the soil itself is hostile?"

"There were water riots," she said. "When it was learned how many people the Duke was adding to the population. That bespeaks a certain hostility."

He said in a questioning tone: "People the Duke was adding to . . ."

"The fighting men," she said. "In spite of the cost, the Duke brought most of his fighting men . . . minimum dependence upon local recruiting. Guards! Guards everywhere. And shields. You see the blurring of them everywhere you look."

He said: "But the Duke is installing new windtraps and condenser equipment, more than enough to care for his own people."

"The population knows that now," she said. "It's what stopped the water riots. But mark the basic hostility of this planet where water is concerned. There is only so much of it to drink. If more comes to drink that water, the price goes up. And then, I am told, the very poor die."

"But the Duke must have some plan."

"Certainly, and I suspect I know what it is, but he has not unfolded the details of it to me." She grimaced. "You know, Wellington, I believe I'm going to hate this place."

"You should give it a chance," he said.

"Give it a chance? Arrakis has been too long under the Harkonnen boot! You know what they do to land and people."

We must get off this subject, he thought. He turned away as though it were too painful to speak.

But Jessica was staring out the window. "I can smell death in this place," she said. "Thufir Hawat sent advance agents in here. Those guards outside are his men. The cargo handlers are his men. There've been unexplained withdrawals of large sums from the treasury. The amounts mean bribes in high places." She shook her head. "Where Thufir goes, death and deceit follow."

"You malign him."

"Malign? I praise him. Death and decit are our only hopes. I just do not fool myself about Thufir's methods."

"You should . . . make yourself busy with things," he said. "Give yourself no time for morbid . . ."

"Busy! What is it that takes most of my time? Acting as the Duke's secretary. So busy that every day I learn new things to fear . . . things even he doesn't suspect I know." She compressed her lips, spoke thinly: "Sometimes I wonder how much my Bene Gesserit business training figured in his choice of me."

"What do you mean?" He found himself caught by the cynical tone in her voice, the buried bitterness that he had never before seen exposed in her.

"Don't you think, Wellington," she asked, "that a secretary tied to one by love is so much safer?"

"Is that a worthy thought, Jessica?" The rebuke came naturally to his lips because there was no doubt how the Duke felt about his concubine. One had only to watch him as he followed her with his eyes.

She sighed. "No. It's not worthy."

Again, she hugged herself, hands pressing against her shoulders as she stared at the dry landscape. And the position of her arms pressed the sheathed crysknife against her flesh so that she felt the outline of it and sensed the unfinished business it represented.

"There will be much bloodshed soon," she said. "This new duchy wasn't a plum they threw to us to buy an end to the feud. The Harkonnens won't rest until they're dead or my Duke destroyed. The Baron cannot forget that Leto is a cousin of the Royal blood, while the Harkonnen titles came out of the CHOAM Company pocketbook. And deep in their minds is the knowledge that an Atreides had a Harkonnen banished for cowardice at Corrin."

"The old feud," Dr. Yueh muttered. And for a moment he felt an acid touch of hate. The old feud had trapped him in its web and these people were part of that poisonous thing. And the irony of it was that the deadliness should come to flower here on Arrakis, the one source in the universe of the spice *melange,* a prolonger of life, a giver of health.

"What are you thinking?" she asked softly.

"I was thinking that the spice is bringing six hundred and twenty thousand *solaris* the decagram on the open market right now. That is money to buy many things."

"Does greed touch even you, Wellington?"

"Greed? No."

"Do not let that happen," she said. "The spice will be a source of riches just as long as Arrakis remains its only source. The day it is synthesized is the day . . ."

"So that's what you fear!"

She nodded. "Else why would they have given us this place? Their intention is obvious: to use Arrakis to destroy us and to gain as much profit as possible in the bargain. It's the CHOAM Company way. It's the Harkonnen way."

I can give her one little comfort then, he thought. *She's* *not a medical specialist and hasn't seen the chemical research papers on melange.*

"It hasn't been synthesized," he said, "and I doubt it ever will be. My school was one of the centers for early study of melange. One of our people was the one who discovered how the spice sets up a protein digestive balance to help the body get more out of what is ingested. The spice presents many faces to the researcher. It should not be stable, yet it is. It should not react differently to the same tests given on successive days to the same spice lot. Yet it does. It adapts and changes yet retains those two priceless characteristics—aiding digestion and the blending of odd pairs and triplets of flavor to make them delightful to the palate."

"Anything can be synthesized," she said.

"Anything that will stand still long enough to be examined," he agreed. "You've eaten spice. Tell me: How did it taste to you?"

"The first time, it tasted like cinnamon," she said. "The next time it tasted something like manccia with just a little pepper sting. Another time it . . ."

"Never exactly the same on two different occasions," he said. "The cinnamon? Well, it's cut sometimes with cassia or cinnamon and it does seem to have some cinnamic aldehyde of its own . . . and eugenol . . . it frequently smells like cinnamon . . . but it never tastes twice the same. Some hold that melange produces *learned* flavors. The body, learning that a thing is good for it, then interprets that flavor as pleasurable . . . slightly euphoric."

She found herself unwilling to give up the fear that *melange* was at the core of the Harkonnen trap. "If not synthesized, then grown somewhere else," she said.

"Where?" he asked. "How? The Harkonnens hid what they could about Arrakis, but there were always the smugglers, and the spice is one of the most fascinating mysteries in the universe. It seems to be a fungasoid, and must grow violently under proper conditions . . . there are certain cell anomalies . . . but what are the proper conditions? Who can study the spice in the desert? Every attempt to grow it artificially has failed. Some think the sandworms hold the key. Perhaps they do. Shall we then go ask the sandworms? They will engulf us as we speak."

She shuddered at thought of the worms.

"You heard the price the Guild asks for weather satellites," he said. "Impossible! And without them, or without long-range transport—which is ruled out by the storms—study of the spice *in situ* is virtually impossible."

"So it remains a mystery," she said.

He saw that he had convinced her, thought: *Thus do I salve my conscience. With one hand I ease the mind, while with the other hand, I prepare death . . . grief . . . betrayal.*

Jessica frowned. "Then the attack will come from another quarter. More and more, I think it would have been wiser for us to go renegade, to take ourselves beyond the Imperial reach."

Yes, he thought. *Why didn't she make him do this? She could make him do virtually anything.* And he spoke quickly because here was truth and a change of subject: "Would you think it bold of me . . . Jessica, if I asked a personal question?"

She turned away, pressed against the windowledge in a pang of disquiet. "Of course not. You're my . . . friend."

"Why haven't you made him marry you?"

She whirled, head up, glaring. "Made him do it? But . . ."

"I should not have asked," he said.

"No." She lowered her hand. "There's a good political reason—as long as the Duke remains unmarried some of the Great Houses can still hope for alliance. But . . ." she sighed, ". . . motivating people, forcing them to your will, gives you a cynical attitude toward humanity. It degrades. If I made him do . . . this, then it would not be his doing."

"It is a thing my Wanna might have said," he murmured. And this, too, was truth.

A wry smile touched Jessica's mouth. "Besides, Wellington, the Duke is really two men. One of them I love very, very much. He's charming, witty, considerate . . . tender, everything a woman could desire. But the other man is . . . cold, callous, demanding, selfish—as harsh and cruel as a winter wind. That's the man who was shaped by the father." Her face contorted. "Oh! If that old man had only died when my Duke was born!"

In the silence that came between them, a breeze from a ventilator could be heard fingering the blinds.

Presently she took a deep breath, said: "The Duke is right: these rooms are nicer than the ones in the other sections of the house—happier rooms." She turned, sweeping the room with her gaze. "These yellow walls give you the feeling of . . . well, sunshine—the kind of sunshine familiar to us." She glanced at the doctor. "If you'll excuse me, Wellington, I want another look through this wing before I assign quarters."

He nodded. "Of course." And he thought: *If only there were some way not to do this thing.*

Jessica went out into the hall thinking: *All the time we talked he was hiding something, holding something back. It was to save my feelings, no doubt. He's a good man.* She hesitated, almost turned back to confront Dr. Yueh and drag the hidden thing from him. *But that would only shame him, frighten him to learn that he's so easily read,* she thought.

IX

Many have marked the speed at which Muad'Dib learned the necessities of Arrakis. Bene Gesserits, of course, do not think this speed unusual; they know its basis. For the others, we can say that Muad'Dib learned rapidly because his first training was in how to learn. *And the first lesson of all was the basic trust in himself that he* could *learn. It is shocking to think how many people do not believe they can learn, and how many more* *believe learning to be difficult. Muad'Dib knew that every experience carries its lesson.*

"The Humanity of Muad-Dib"
by The Princess Irulan

Paul lay on the bed feigning sleep. It had been easy to palm Dr. Yueh's sleeping tablet, to pretend to swallow it. Paul suppressed a laugh. Even his mother had believed him asleep when she came and looked in the door. He had wanted to jump up and ask her to let him go exploring in the house, but she'd never have given that permission. Things were too unsettled yet. No. This way was best.

If I slip out without asking I haven't disobeyed orders, he thought.

He heard his mother and Dr. Yueh talking in the other room. Their words were indistinct . . . something about the spice . . . the Harkonnens.

The conversation rose and fell. Paul thought of his mother, of the new training, of the hurried sense of danger on Arrakis. His attention was caught by the carved headboard of his bed—a false headboard attached to the wall and concealing the controls for this room's functions. A great leaping fish had been shaped on the wood with thick waves beneath it. He knew that if he pushed the fish's one visible eye that would turn on the room's lights. One of the waves controlled ventilation; another changed the temperature.

Quietly, Paul sat up on the bed. A tall bookcase stood against the wall to his left. It could be swung aside to reveal a closet with wardrobe drawers along one side. A door in the far wall let into the hall.

The room was full of such things, as though it had been designed to entice him.

The room and this planet.

He felt impatient for his mother to leave the other room, for things to quiet down and give him the opportunity to escape this confinement.

He thought of the filmbook Dr. Yueh had shown him—"Arrakis: His Imperial Majesty's Desert Botanical Testing Station." Names flitted through his mind, each with its picture imprinted by the filmbook's mnemonic pulse—saguaro, burro bush, date palm, sand verbena, evening primrose, barrel cactus, incense bush, smoke tree, creosote bush, wild buckwheat . . . Names and pictures, names and pictures—many from mankind's Terranic past and no longer to be found in the Universe except here on Arrakis.

The names added to the mystery and enticement of this place. So many things to learn.

There was *melange*—the Spice.

And sandworms.

Nothing else about this planet signaled danger as strongly as did the thought of these worms. Terrible winds, poisonous creatures, Harkonnen assassins, perils of thirst—none of these seemed as real in their threat as the sandworms.

In a way, the sandworms had become mixed in his mind with the Harkonnens, a tangible comparison: the Harkonnens were human sandworms who wanted to swallow him.

A door closed in the other room, and Paul heard his mother's footsteps retreating down the hall. Dr. Yueh would remain, of course, believing Paul to be asleep. The doctor would find something to read.

Now was the moment to escape.

Paul slipped out of the bed, started toward the bookcase door that opened into a closet. He stopped at a sound behind him, turned. The carved headboard of the bed was folding down onto the spot where he had been sleeping. An odd fang protruded from the fish's eye.

He froze in the grip of fear. Immobility saved his life.

From behind the headboard slipped a tiny hunter-seeker no more than five centimeters long. Paul recognized it—one of the common assassination weapons that every child of royal blood learned about at an early age. It was a ravening sliver of metal guided by some nearby human eye and hand, and it could burrow into any moving thing of soft flesh, following nerve channels to the nearest vital organ.

(To be continued)

IN TIMES TO COME The cover next issue will be one of our exceedingly rare purely photographic covers—and will look like an abstract painting of a cathedral window. Make's a gorgeous Christmas cover—and is, in fact, an illustration for an article on evidences of life in meteoric material by Dr. Ralph Hall. It's a photograph of a microscopically thin slice of a meteor, viewed by transmitted polarized light under a microscope. We don't ordinarily (1) put photographs on the cover, or (2) put article illustrations on the cover. But this one can't be done in black and white, without losing ninety-five per cent of the punch—and it's too beautiful an abstract color composition to miss.

Part II of "Dune World" of course—and a novelette by Randall Garrett, which violates several basic rules of science fiction. It's a detective story—they don't work in science-fiction—and it's based on magic, not science. And the whole thing, which happens in 1963, is because King Richard the Lionheart, after being wounded by the Saracens, came home from the wars and settled down to being a good, wise, and powerful King . . . THE EDITOR

CONVERSATION IN ARCADY

Perhaps one of the advantages of a relatively short life span is that we don't have to meet the changed ideals and concepts of another century . . .

POUL ANDERSON

Illustrated by John Schoenherr

So that's what a spaceship looks like, Bill thought.

It rested in the valley beneath him, near the river, with an arm of the woods for background. Mist flowed like white smoke around the lancehead shape. Where sunrays struck across the eastward trees, the metal shimmered. High overhead a fish hawk went circling.

Linda caught his arm. "Did that really go to the stars?" she asked. "It seems awfully small." Her voice fell low in the quietness, which nothing but the birds broke otherwise.

"Well, not under its own power," he admitted. "The mother vessel's too big to come down. Has to stay in orbit. That's one of the shuttle boats. But, yes, it was there." He squinted into the light, trying to make out details, as if he could see the scars of cosmic dust and strange landings. The distance was too great, though. "C'mon," he said.

Charlotte made a face. "Nothing doing. My feet ache."

They had come only a few miles from the chalet, but she wasn't used to walking. And, of course, they'd had quite a night. Bill knew that before long he'd start feeling the effects himself, and curl up for a ten- or twelve-hour sleep. But the stim pills hadn't worn off yet. He'd taken an extra dose yesterday evening—Charlotte and Linda were plenty healthy girls—and still felt fine. It had been his idea that they stroll around and say hello to the spacemen, seeing how near they happened to be to one of the announced landing places.

"Don't you want to meet the boys?" he asked. "They should be quite a novelty. Not just that they've been so far away they couldn't see the sun without a telescope, but they were born more than three hundred years ago. Some of them may have known Thane himself. It's a safe bet they've lived in cities—"

"Why, they'll be *ancient!*" Charlotte said with a shiver. She wasn't stupid, but she had no more information about technical matters than the average person.

"Nonsense, dear," said Linda. "When you move almost at the speed of light, time slows down for you. I never could understand why, but it does. I don't guess they've aged more than twenty or thirty years in their traveling. If you take your Anti-Eld—they did have Anti-Eld back then, didn't they, Billy, darling?—that's not too big a percentage of a lifetime. I'm sure they're fascinating."

"Well they can fascinate me some other day," Charlotte grumbled. She yawned, shook the yellow hair off her shoulders, and drew her cloak tight around her. "I'm cold and sleepy and I'm going to call me a flitter and go to bed."

"As you like," purred Linda, and held Bill's arm closer.

Charlotte touched the cab summons button on her talkie bracelet, with a defiant little look at him. He grinned, chucked her under the chin, and started downhill. The grass was cold and wet where it brushed his bare legs and sandaled feet. Linda paced him. A breeze fluttered her dark locks and her cloak, which she hadn't fastened.

Bill gave her a sidelong glance. "So you do figure to latch onto a spaceman, sweetheart?" he murmured.

"Why not? He'll be something different." She patted his head. "Not that I've got any complaints, Billy. Let's make a private date sometime, hm-m-m?"

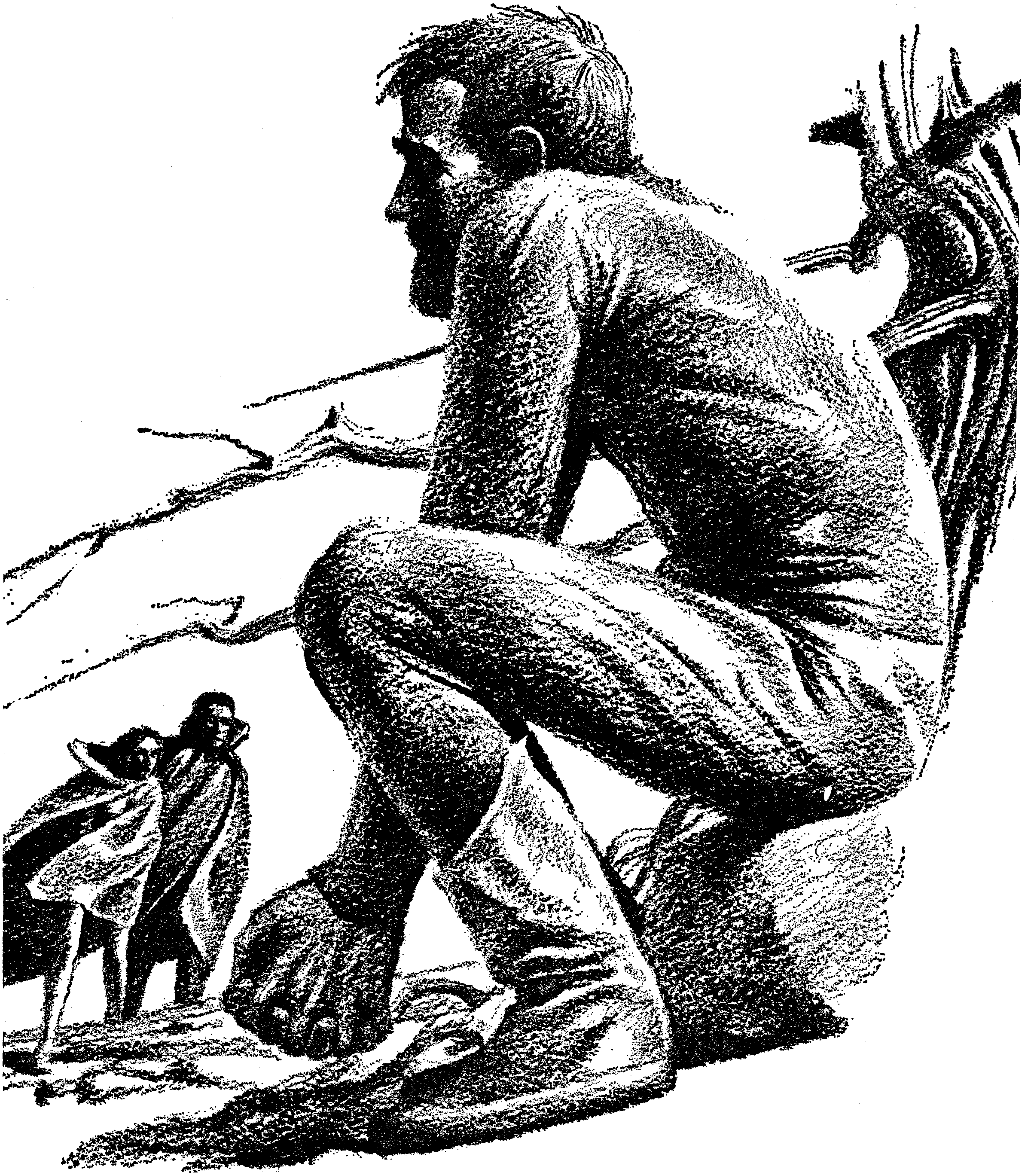
"With pleasure. Uh, do me a favor, though, will you? If I get talking to one of the crew, don't wiggle yourself at him. Pick somebody else. You can take your pick, I guarantee."

"Sure. But what, if I may ask, do you want with your man?"

"Gab. A lot of gab. I've often wondered what it's like, out there among the stars."

"You're a funny one," she said with amused affection. He allowed himself an inward smirk. Though his intellectual curiosity was genuine enough, his flaunting of it was calculated. You needed some point of uniqueness these days.

A flitter must have been hovering quite near, for it landed by Charlotte at that moment. Linda and Bill turned to wave good-by. The shimmer of the drive field distorted his view of her figure, which would ordinarily have been a pity. But he wasn't feeling frustrated about her, or anyone, this morning. She waved back, drowsily, spoke an order to the robot, and took off. The egg shape was soon lost in that big empty sky.



A rustle of underbrush yanked his attention downward. Having no enemies that he knew of, he didn't draw the blastgun on his hip, but he kept a hand near it as he turned around. People didn't often sneak up on you unless they were looking for trouble.

Or were spacemen, he realized. The tall, black-clad form that stepped out of a stand of beeches could only be from the ship. Clothes like that hadn't been seen on Earth since the Dispersal. And the man had short hair, and a beard, and unhappy eyes. He was weaponless, too. Must simply have been out for a walk, Bill decided, had seen the flitter descend and headed in its direction.

"Oh!" Linda exclaimed. Remembering what they were here for, she gave the newcomer a slow smile and let her cloak fall so it showed exactly as much as she wanted him to see for a beginning.

A flush went up his long cheeks. He shifted his gaze to Bill, who considered that foolish. *Though come to think of it, didn't I read, or hear on a sensecast, or something, that the expedition had women along?*

No. He was wire tense.

Bill made a formal bow, gave his own name and Linda's, and said, "Peace to you" with hands held open.

The spaceman took a jerky step toward him, and another, before stopping. "Lieutenant Owen Garst," he said thickly. "At your service."

"Three names?" Linda raised her brows.

"Two names and a title," Bill told her. "The ancient style. He'd be Owen." To him: "Pleasure meeting you. We came to visit, if you're willing."

Owen's mouth twitched. "Willing? Oh, yes. Very much so. After all, you're the first. We landed three days ago, and you're the first who've come to see us." His accent was harsh and Bill couldn't follow some idioms; but on the whole, language hadn't changed too greatly since the starship left.

"He's terribly hurt about that," Linda whispered to her companion. She approached Owen, holding out her hand. "How strange," she said aloud, "but I guess not many people have heard you were here. And then, this is a wilderness area, sort of."

His eyes locked with hers, his arms remained at his sides, and he answered grimly: "That makes no difference when you have flycars. Does it? Besides, we spotted our boats evenly around the planet, to give everyone an equal chance. We've kept in radio contact with each other, so I know what's happened—or not happened. No boat has had more than a dozen visitors."

"What'd you expect?" Bill asked in surprise.

"Five million people came to see us off," Owen said, still watching Linda as if he accused her of something. "They estimated that three billion more watched on television."

"Three billion?" Bill whistled. "Were there really that many then?"

"More. What's the population now?"

"Gosh, I dunno," Linda said. She noticed that her hand was still ignored and withdrew it. "Ask Billy. He reads books."

As Owen's gaze smoldered toward him, Bill shrugged. "How should I know? Nobody's counted. If I had to make a guess . . . uh, let me see. I never thought about it much. A hundred million? Maybe something like that."

"On all Earth?" Owen's bony head shook, back and forth, like a stunned animal's. "We saw from space that the cities were abandoned and falling to ruin," he sighed. "But we heard some radio talk. The one we contacted invited us right on down—and then we couldn't find him. What's happened?"

Suddenly he sprang. His fingers clamped onto Bill's shoulders with bruising force. "*What's happened?*" he screamed, and shook the other man till teeth rattled.

Bill jerked free, crouched back, and drew his gun. "Hold on there!" he rapped.

"Billy!" Linda seized his wrist.

Owen stood gasping. The young sunlight glittered off sweat on his face. "Don't hurt him," Linda begged.

"Then let him behave himself," Bill said through his anger.

"Can't you see, he doesn't know any better?"

As if her words had opened a valve, the emotion drained from him. He even laughed a little as he holstered his gun. "All right," he said. "You're excused, friend. But watch your manners. Not everybody's got an easy temper or an understanding girl like me."

Owen blinked rapidly. For a moment he stood slumped. Then he turned blindly away, stumbled a few steps downhill, jackknifed his long black form onto a boulder. He sat there with hands hanging between his knees.

"Maybe you better run along, honey," Bill muttered to Linda. "Nothing here for you, I'm afraid."

"I'll say! But I'm sort of interested anyhow. I do think of something besides men, you know, once in a while."

She had, in fact, done a few water colors. It was one thing that had attracted Bill to her. He liked women with brains. He spread his cloak on the grass near the rock and sat down. She joined him.

A shudder went through Owen. He lifted his face, looked squarely at them, and said in a flat voice, "I'm sorry if I've violated any code of behavior. Obviously things have changed in three hundred years."

After a pause, he went on, almost too low to hear: "We expected that. We knew we, our wives and children, we'd come back as strangers. It's so horribly far to the nearest star with a planet men can live on. We had so long a hunt—cold red dwarf suns, worlds with poison in the air and things walking the land such as you don't see even in dreams . . ." His words trailed off.

"What's a wife?" Linda asked in Bill's ear.

"A permanent sex partner," he told her. "They used to have them."

She frowned in puzzlement. "Whatever for?"

"But we found it!" Owen shouted. "A planet like

Paradise, waiting for us these five billion years. And we came back. And what's happened?"

Bill began to see what a shock it must have been. He had read some of the history books lying around in the old libraries, which helped him remember the smattering of the subject he had gotten in autocation. He drew a breath and picked his words carefully. "Well, the Bio War must have broken out a . . . uh . . . about a century after you left."

Owen's fists lifted, and fell again till they rested on his knees. "We didn't believe Earth could go on the way it had been going," he said. "Overcrowded, overcivilized . . . One reason why the expedition went. To find another planet, an outlet. Did the war destroy civilization, then?"

"Oh, no," Bill said, amused in spite of himself. "The buildings and machinery and such weren't hurt at all. But the germs got nearly everybody. After that, the others had it good. Each man could use what thousands, maybe millions had been using before. Robots to do the work, even skilled work like doctoring."

"And bringing up children?" he flung at them.

"Why, of course," Linda said. "Not that there are a lot. Most girls would rather not be bothered. But when they come along, we're fond of them, really we are. My half-sister has her Tommy living right with her."

"And maybe you didn't have autocation in your time," Bill suggested. "Machines to put what you need to know right into your brain."

"You don't seem to have much use for knowledge," Owen said furiously.

Linda laughed. "Whatever for?" she said again.

The spaceman looked away, across the valley and the hills toward the snowpeaks that seemed to float in the western sky. "To know. To have a foundation for new knowledge, discoveries, things never done before."

"Shucks, there're too many new things for one lifetime already," Bill said. "Like me, I've never yet been in Carlsbad Caverns, or smoked sho-nuff opium, or made love to Linda's half-sister—"

"From what I hear, you haven't missed much," she said.

"But don't you care about the future?" Owen's voice cracked. "What'll become of your grandchildren?"

"That's their problem," Bill shrugged. "Though I don't expect the world'll be any different for them."

The conversation was beginning to bore him. He had wanted to hear about romantic adventures on foreign worlds, not argue psychologics or whatever it was called. So he noticed how tiredness had crept into his muscles and decided that a large breakfast and a long nap weren't such a bad idea.

"No directing purpose," Owen mumbled. "Don't you even have a government?"

"What's that?" Linda asked.

"People used to tell other people what to do," Bill explained, hiding a yawn.

"Huh? Sounds crazy. How'd they make them do it?"

"Ask him." Bill jerked a thumb at Owen. But the spaceman looked so woebegone, sitting there shivering in the dew, that Bill had to continue in a kindlier tone:

"Look, friend, when there's plenty of elbow room, and the machines give you everything you need, what more does anybody want? I suggest you fellows catch flitters to the nearest supply depot and outfit yourselves. Then settle down, take rooms in a hostel or find a house, some area you like, and wait. You'll get lots of invitations, as the word spreads. Novelties are always welcome. You've done a long, hard job. Now relax and have fun."

Owen stared at him. The landscape grew so still that you could hear the air whistle in the pinions of the hawk. Bill's eyes wandered drowsily away from the spaceman's. The fog was vanishing down in the valley; a hundred different shades of green showed through.

After a very long while, Owen's mouth gashed open and he said unsteadily, "Is that all it means to you, what we did? A job?"

Sleepier by the minute, Bill couldn't think of any reply.

"It was a mission," Owen said. "We went to plant the seed of man among the stars. A whole universe is waiting for us out yonder. We found one planet to colonize; but there must be millions. And men can learn, and strive, and . . . No, you can't just stay here. You mustn't!"

His yell jarred Bill awake. Linda felt how her companion bristled. She squeezed his shoulder as if to say once more, He doesn't know any better. Her words were quick and polite. "Well, I hope you can get somebody interested. It must be real thrilling. Very glad to have met you." She rose. "Let's go, Billy, shall we? I'm dead on my feet."

"Me, too." Bill got up. Owen remained seated. The muscles jerked in his face, and Bill wondered if the man was about to cry. "Good day, friend," he said.

He walked back uphill with Linda, to get out of sight before calling a flitter. Otherwise he might have had to continue that embarrassing session while they waited. At the edge of the woods, they paused to glance back. Owen was still sitting on the boulder, an angular blue blot under the sky.

Bill chuckled. "Want to try another spaceman?"

Linda wrinkled her snub nose. "Not if they're all such crawlies."

"Oh, well," he said, to maintain his reputation as a thinker, "times change."

They flitted to Pike's Peak Chateau, where the robots were taped for a champagne breakfast, and afterward went off to rest. When they woke, he called Bertie in New Zealand, who said there'd be a party at Marie's, so they went on over. Linda got considerable conversational mileage out of the morning's encounter. Bill avoided the subject. It made him feel a little uncomfortable, somehow.

Not long afterward, he heard that the spaceboats had lifted. Since they never came down, it appeared that the starship had departed Earth. He often wondered why. ■

THE RIGHT TIME

The trouble with prophets is that if
they're accurate, the news won't do you any good,
and if they aren't accurate, they're no good.
Unless, of course, they're more
than just prophets . . .

WALTER BUPP

Illustrated by George Schelling

"Don't let the old goat rattle you, Pheola," I said as we rode the elevator to the penthouse. "He'll try. Just remember, he is the one who has to say O.K. if we are to give you some training."

Her eyes rolled and she moaned softly, clinging to my arm. "Oh, Billy Joe!" she whispered. "I *don't* want to fail you!"

Maragon has some pretty creepy types in his office and the receptionist that day was no exception. She was one of those twitchy hyper-thyroid clairvoyants that he likes to test.

"Don't tell me," the receptionist twitched proudly as we came in. "I know!" She got up from behind her desk and led us to the Grand Master's private office.

I intended to make her guess whom I had with me, but that didn't bother her. "Dr. Walter Bupp and Pheola Rountree," she announced smugly. Clairvoyants live in a condition of perpetual thrill with their powers.

Maragon's penthouse office has glass walls on two sides. He was prowling back and forth in front of his desk, sharply lit by the bright sunlight that streamed in. His gray shock of hair glistened, and his bushy eyebrows shaded his face. He radiated impatience, from the grinding of his square jaw to the fists he had rammed into his hips.

"Lefty," he greeted me, "do they all have to *look* alike? Where did you get *this* scarecrow?"

I could feel Pheola stiffen. I guess no woman, no matter how plain, likes to be reminded of it.

"Same place you dig up those twitchy CV types you have spooking up your outer office," I snapped. "There's nothing the matter with Pheola that three square meals won't cure in a month!"

Maragon grunted. "And just what wonderful power do *you* have, young woman, that makes it worth while for the Lodge to fatten you up?" he demanded.

She had plenty of spunk, I'll say that for her. "I have the power of prophecy, and the gift of healin'," Pheola said, squinting at him.

He barked a laugh at her and went across the thick carpet to sit in his swivel chair. It was a beauty of dark green morocco that matched his Bank of England chairs and the leather sofa that was against one of the walls. "What's your favorite prophecy, young woman?" he wanted to know.

Pheola smiled over at me. "Oh, no!" I groaned, but she nodded.

"Billy Joe and I are gettin' married," she told Maragon.

"Billy Joe?" he asked, scowling at me across his desk.

"That's me," I said. "Don't ask me where the name comes from."

"I couldn't care less," Maragon grumped. "Is it true? Are you going to marry this bag of bones?"

I could feel my face getting red. "Not that I know of," I said.

He swung around in his chair to face her. "Young woman, someone has told you how much the Lodge is interested in precognition. You wouldn't walk in here claiming the power if you didn't know we want to find it, and rarely can. But you certainly came ill-prepared. Going to marry Lefty, eh? Why, you can't predict the right time!" He banged his fist on the big slab of walnut. "You're a fake!" he said.

"I *ain't* a fake!" Pheola protested. "We *will* get married!"

"Drag her out, Lefty," Maragon said wearily, with a limp wave of his hand.

"Come on, Pheola," I said, taking her arm with my right hand. I saw no point talking with him any further.

"Lefty!" Maragon exclaimed.

"Yes?"

"You used your right arm! You can't *move* it!"

"I can now," I told the old goat with relish. "Pheola told you she was a healer. Well, she healed me a . . . a couple days ago!"

He went for the jugular: "Have you ever done anything like that before, Pheola?" he demanded.

"Mostly small ailin'," she said, squinting and backing away from his desk defensively. "Never nothin' as big as findin' the weak spot in Billy Joe's haid. But I *told* you I had the power of prophecy and the gift of healin'."

I suppose her degree of humility decided him. "She can stay," Maragon said. "Look into this healing thing, Lefty. But, for the love of Mike, don't waste time with her precognition."

Pheola moaned, then keened, and waved her hands in front of her face, as if to ward off a swarm of bees. "My healin' won't do *you* much good, you nasty old man!" she said in a shrill voice. "You'll git a pain, *sich* a pain," she insisted, pressing her hand to her heart. "It will like to kill you, and it nearly will!"

Maragon laughed at her again. "A young witch!" he proclaimed. "I'll bet you scared half of Posthole County into fits with dark remarks like that. Take her away, Lefty!"

Pheola didn't break her silence until I showed her into the apartment adjoining mine in the Chapter House. The Lodge Building is a hundred stories high, and most of it is devoted to offices that we rent out to doctors, lawyers and the like. We only use a part of the place—there just aren't that many Psis around—and save a few floors for apartments for members permanently assigned, as I am, to Lodge duties

Pheola stood stiff and unseeing in the apartment, her fists clenched at her sides, plainly in no shape to appreciate her rooms. They were in the usual good taste I always associate with a Psi decorator.

"How could I let you down, Billy Joe!" she said to me, as soon as the door to the corridor had closed behind us.

"Oh, stop it!" I snapped, giving her a shake. "Weren't you ever wrong in a prophecy before?"

She squinted to see me better. "Does it make you hate me?" she asked. "Yes, I've been wrong lots of times," she admitted. "But not about marrin' you. How does he know I'm wrong?"

"He doesn't," I growled. "He just doesn't believe in precognition. What little we see of it in the Lodge is so erratic that you can't count it as a proven Psi power."

"Then maybe I *am* right," she pressed me.

"Not if I can help it," I said sourly. "I'm in no mood to get married. Mostly I want to give you some advice. O.K.?"

She made cow eyes at me. "You know you can, Billy Joe," she said.

"Well," I snarled, "my first suggestion is that you cut out this 'Billy Joe' stuff. My name is Wally Bupp. You can call me Lefty if you want to. I'm not your darlin' Billy."

"I tole the truth, and you hate me for it!" she said hotly. "I was afeered of that."

" 'Afeered!' " I sneered. "All that corn pone and chitterlin's dialect! You can cut that out, too, can't you? Wasn't that just part of your local color?"

"Sort of," she admitted, switching to the neutral American dialect. "Yes, I can cut that out, too, Lefty."

"Good. I'm willing to take a couple chances with that old goat, because I believe in you. I saw you in action in Nevada, and you sold me that you have some Psi powers. We'll work on your healing, as Maragon suggested. But I want to have your precognition tested. Just keep your mouth shut about it here in the Lodge, do you hear?"

She nodded.

"All right," I said. "I'll have to make some arrangements, or Maragon will have my scalp. In the meantime, why don't you fix up so we can go out to dinner?"

She gave me a look of adoration that would have curdled fresh milk. "Oh, Lefty, I'd love that." And then her face fell. "But I don't have a thing to wear!"

I don't think she was exactly a moocher. She *didn't* have anything to wear, when I thought of it. "Sure," I said more mildly. "Well, that's the good part of getting some training here. The Lodge will take care of your needs. Just call the girl on the desk and say you need some clothes. She'll send somebody over from one of the department stores."

Pheola's eyes grew round. Ordinarily she squinted when she wanted to see anything. "What should I get?"

"Start from the skin and work out." I told her. "Tell the department store you'll be working in an office, and that you'll need a couple of cocktail dresses and wraps for evening, too. Get lots of shoes. O.K.?"

Was it ever!

I had an idea that clothes would be quite a change for Pheola. I had met her only three days before, in a Nevada gambling house. She'd made for me like a lodestar, called me her Billy Joe and announced that I would be her next husband. I'll tell you, that was a shocker. I'm not about to marry anybody. She was as tall as I was, which isn't so very much for a man, skinny to the point of emaciation, wearing a "borrowed" dress that didn't fit, and had that unmistakable slatternly look that you associate with white trash. On top of that, she was vain enough about her bucktoothed and pointed-nose features to keep her glasses in her purse, and as a result she went around peering at you from a distance of eight inches to make sure you were the right guy.

But she had Psi powers. She had been hot as a firecracker predicting the roll of dice on the gambling tables, the very dice that I was tipping with telekinesis. Much more important to me personally, she had announced that she was a healer, and on my dare had "laid hands" on me, and brought my dead right arm to life.

My obligation as a Lodge official was to bring her to the Manhattan Chapter for measurement and training, no matter what the Grand Master felt about the reality of her powers of precognition. Maragon had been about as obstreperous as I had figured. We have a lot of trouble working together, probably because he resents my TK powers. He's good at it, but I'm a good deal better. That's why I'm a Thirty-third Degree member of the Lodge.

Leaving Pheola's new home, I went next door to my own apartment and checked in by phone with Memorial Hospital. Fortunately, I was not on call, and could take a few steps to find out how much PC Pheola really had. I went down to the forty-third floor, where we have our laboratories, and let myself into the data-processing center.

They don't like me to do that. That place is under full temperature and humidity control, and every time an outsider barges in the whole system does nip-ups.

Norty Baskins came scurrying away from a card sorter. "What's this!" he exclaimed. "Oh, it's you, Lefty." His face went solemn with his effort, and I felt a twinge in my ear lobe. I returned the grip, tweaking his ear the same way. He began to smile, realizing that I had felt his lift and was returning it.

"You shouldn't be in here, Lefty," he said. "You know the rules."

"And I know this is the time to break them, Norty," I said. "I've got something really rare for you."

"Rare?"

"This time I've really got one," I insisted. "A precog who can call things with pin-point accuracy."

"Not again, Lefty," he said, disgusted. "Aren't you getting a little tired of striking out on that prediction? You've brought half a dozen flops in here in the last year."

"Not Pheola," I said. "Listen, Norty, I want this girl measured."

"I thought you said she was pin-point accurate," he sneered. "And what does Maragon say?"

I waved a hand at him and walked over to sit on one of the lab stools. He went to the sorter and pulled cards from the bins, joggling them up into one solid stack that he put back in the hopper. But he did not press the "start" button.

"You know, Maragon," I told him. "This girl is hot, and then she's cold. But there is so much accuracy when she's right that I think there's some future to training her. What I want out of you is a measurement of how great her accuracy is."

Norty snorted. "When Maragon doesn't believe it?" he said. "No thanks." He started the card sorter, filling the room with its clatter.

I drew a pair of dice from my pocket. I'm never without the ivories. They are the original instruments of my TK skill. That's how Maragon found me, unconsciously tipping dice in an alley crap game. I threw them out on the table next to the sorter, when the cards had gone through and it fell silent. They came up with a four-three natural.

"Maragon!" I snapped. "You know he doesn't think enough of *your* TK to have your training extended. Well, you and I both know we have done wonders for your grip. Just because he's Grand Master doesn't make him right all the time. I want you to test this girl, and I think she has as much right to the facts as you have to the training I've been giving you under the table all these months!"

"Blackmail," he said sadly. "Extortion!"

"So I'm extorting some work out of you," I agreed. "The only question is whether you will pay."

"What do you want?" Baskins asked glumly.

"I want you to make this woman predict a series, a number of series, and I want you to use your computers here to tell me on what basis her accuracy varies. You can do that, can't you?"

He nodded, staring at the dice on the table. "If I wasn't so sure you can help me develop my TK, Lefty," he said, "I'd never do this. All right, sneak her down here and I'll get her to PC some weather information for a month or so."

"Weather?" I said. "Why the weather?"

"You'll see when I show the results," he said. "Roll those dice again. I swear I felt your lift that last time."

I made a few other calls around the building to catch up on what had been going on while I was in Nevada. Our formal organization is lousy, because Maragon is a one-man show. You just have to rely on gossip, what the CV's pick up and what leaks by telepathy, to know all the internal politics of the Lodge. I wouldn't want you to think that Psi's are more devious or Machiavellian than normals, but sometimes they act it.

By the time I reached up to tap on Pheola's door, it opened in front of me, and a stylishly dressed young lady came out, smiling, with Pheola standing in the doorway behind her.

"Lefty!" Pheola said happily.

"Is this your fiancé?" the girl said to Pheola.

"No!" I said. "I'm her chiropractor, and I'm about to straighten out some vertabrae in her neck!"

Something about the way I said it made the girl from the department store scuttle down the corridor. I glared at her back, went into Pheola's apartment and shut the door.

"What were you telling her?" I started, and then I knew there was no point to it. I waved an irritated hand and kept on talking.

"When will your clothes be here?"

"Some things for tonight in about an hour," she said meekly. "I got quite a lot. Was that all right?"

"If you keep shooting off your puss about our getting married, you won't last long enough to wear them all," I threatened. "Can you find Room 4307, or will I have to take you down?"

"I can find it if you want me to, Lefty," she said.

I was sick of being her darlin' Billy. "Then find it," I said. "Ask for Norty. Tell him you are my PC. Do what he tells you. I'll pick you up around seven o'clock back here. All right?"

"All right."

"And stop telling people we're going to get married!"

She didn't answer that, so I let myself out and went to my own apartment, sizzling.

The phone was ringing as I came in, and I walked over to press the "Accept" button. The screen lit up to show me a lined and wrinkled face framed in scraggling hair streaked with gray.

"Hello, Evaleen," I said to her.

"This is dynamite," she said in a graveyard tone. "In the gym, in about ten minutes?"

I could feel my eyebrows rise. "Sure," I said, and before I could foolishly ask her what it was all about, she cut the image.

It isn't that our phones are tapped. Maragon doesn't need that. But in a building full of telepaths, any conversation is going to be peeped if you carry it on long enough. And who can keep his mind closed while he's talking? It's hard enough when you're silent.

I rode directly down to twenty and let myself into the locker room. By the time I had changed into my gym suit, Evaleen Riley's ten minutes had elapsed, and I went into the gym.

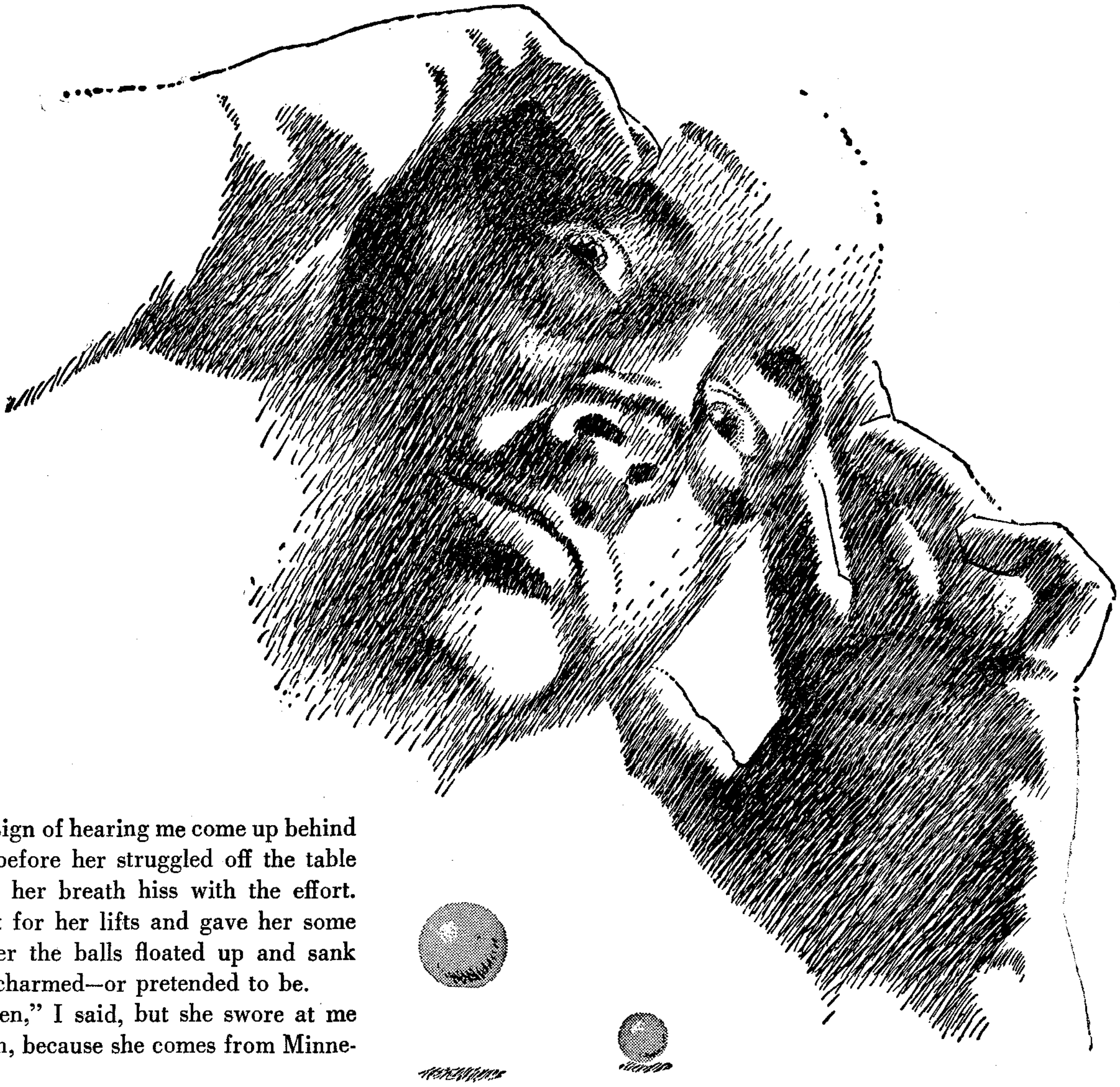
If she wanted to be careful about our conversation there was no point going directly to wherever she was working out, so I wandered.

There was the usual dozen or so TK's there practicing with the weights, as well as twice as many who thought they were TK's trying to get the milligram weights to wiggle. About half of them were clustered around one table where a member from one of the other chapters was showing off by heaving at a two hundred and fifty gram weight. He was seated in the classic position, his elbows on the table, his fingers supporting his temples, and was concentrating fiercely on the weight.

He wasn't really up to it. I could see sweat starting from his brow as I watched him over the heads of the others at the table. Suddenly he dropped back, exhausted.

"Not tonight, Josephine!" he gasped. The man at his right, another stranger, chuckled, reached over to touch the weight with his finger tips and then TK'd it cleanly off the Formica. It was nice work, for a middleweight.

I looked in at a couple other workouts before wandering over to where Evaleen sat by herself in a corner. She was concentrating on a series of pith balls the size of peas that weighed from a tenth of a gram up. She was either so absorbed in what she was doing, or pretended



to be, that she gave no sign of hearing me come up behind her. One of the balls before her struggled off the table top, and I could hear her breath hiss with the effort. Cheating a little, I felt for her lifts and gave her some help. One after another the balls floated up and sank back. She was utterly charmed—or pretended to be.

"Great going, Evaleen," I said, but she swore at me in Gaelic, an affectation, because she comes from Minnesota.

"You'd slip up behind me and help, eh?" she said hollowly.

"Get a touch, Evaleen," I suggested. "Have you tried it?"

"No," she said sullenly. She's good at that. Her dark hair is streaked with gray. She lets it hang down straight and whacks it off with hedge shears or something when it bothers her. Her face is lined and wrinkled far ahead of its time, and I swear, from the color of her teeth, that she chews betel nut. Somehow or other these PC witches have to act the part.

"Go ahead," I insisted. "Touch the first ball with the tip of your finger, Evaleen." I showed her what I meant by leaning over her shoulder. "That's right. *Now* lift!"

The pith ball rose smoothly several inches, and she held the lift for ten seconds or so.

"You were helping," she accused me in her best graveyard tones.

"Never," I said, truthfully. "Don't feel that it's cheating to get tactile help. I just saw a two hundred fifty gram middleweight over there at the other table run his fingers down a weight before he lifted. We all do it. It helps the grip."

"*You* never do," she accused me.

"On the big ones, Evaleen, sure I do. I'm a little sneaky about it, but I usually get a touch. Try a bigger ball."

I looked around the gym while my encouragement helped her. No one was paying us any special attention, and I saw none of the better known telepaths in the room. That didn't mean too much, for any number of the TP's in the Manhattan Chapter had good range.

Evaleen was getting good lifts on the one-gram ball when I slipped her the question: "You said it was dynamite," I said, and closed my mind to the thought.

Her lift broke. "I'm worried about the old goat in the penthouse, Lefty," she said in a low tone. It didn't make any difference. She might as well have shouted if a TP were peeping her. I took up for her with the pith balls and had them hopping up and down discreetly, just as though she were still working at her lifts with my coaching.

"You been life-lining again?" I hazarded, largely because of what Pheola had said about Maragon's having a heart attack.

"Yes, and he's going to be sick—I feel it very strongly."

"Die?"

"He'll outlive me," she said, more glumly than ever. I knew she could not predict past the span of her own life.

"And how long is that?" I needled.

"You can count my time in years, but not enough of them," she said, irritated that I had asked her about her own span. I knew I shouldn't have said it. She had read her own future and found it wanting. "But death hovers close in it," she went on. "You know I don't get clear pictures, Lefty, just a feeling. Death is very, very close. And you are in it."

"And who else?" I pressed her.

"No one I ever met," She said, telling me another limitation of her powers.

"Perhaps I can cure that, Evaleen," I said, letting the last ball drop. More loudly I added: "You get better every day. You could qualify for the second degree if you can do as well under standardized conditions."

"Yes," she agreed. "We've talked enough. You will act on it?"

"Oddly," I said. "I already have. You confirm what another PC says. I'll have you meet her."

"You will not," she said. "I can't stand PC's!"

"Now try that big one," I said, pointing to a small brass weight of two grams on the table.

She touched it and it lifted. She cried out in pleasure. "That's my best!"

"You were never that mad when you were lifting, I guess," I said. "Big emotions make big lifts. Fall in love—you'll do better still."

"First decent argument for getting tangled with one of you men I've heard yet," she lied. Wild as her looks were, she'd been a favorite around the Chapter for years.

I patted her on the shoulder and went back to the table where the big weights were being lifted and showed off for a couple minutes. The inevitable hour of shop talk and demonstrations followed as soon as the out-of-towners found out who I was. They don't meet a Thirty-third every day, and face it, I'm a TK bruiser.

After enjoying some slaps on the back, I took my shower, changed back into my clothes and went to find Pheola.

She had just finished her shower and had gotten dressed as far as her slip when she let me in.

"What an awful man!" she greeted me.

"Norty?"

"Yes! He doesn't believe in me a *bit!*"

"I don't either," I grinned. "Remember, you're the fake who says we're getting married."

"We are, too!" she said, sulking. "He made me tell him a thousand things," she added, going over to her couch where three dresses were draped. "What should I wear?"

"The blue one," I said. "Blue-eyed blondes should wear blue." I was stretching a point. "What did he make you PC?"

"All about the weather," she said, somewhat muffled as she slipped the dress over her head. I helped her with a zipper and a catch. "About thirty cities, Lefty. He made me tell him the temperature and the barometric pressure every hour for about a month! I never did anything like that before."

"Um-m-m," I said, as she fooled around getting her hair in some sort of shape with a clip. It was straight hair, and not much could be done with it. "Were you right, though?"

"Yes," she said, convinced. "I was very sure. Lefty, I *want* to do it, for you!"

"Sure," I said. "Let's go."

The Lodge has good food, but you get tired of hanging around with a bunch of Psi's, so we went on the town and found a good spot for dinner. What with rubbernecking at the big city, it was some after ten o'clock before we got back to the Chapter House and rode up to her apartment.

Pheola was bubbling happily about our evening. As she keyed open her door, I pushed her into her place and came in with her.

"For a couple who are going to get married," I said, grinning at her, "it's time we made a little love, Pheola."

She squinted myopically at me, not sure if I were serious. "I thought you weren't going . . . " she started.

"I'm not," I assured her. "I'm talking about our special kind of love. Know what I mean?"

She shook her head doubtfully as I took her wrap and hung it in the closet.

"Let's face a couple facts," I said, as I led her to the sofa and we sat down. She squeezed up close to me, so that our knees were touching. "I believe in you, I've told you that. I have seen you predict the future. More than that, I have felt you cure me. But precognition is hard to prove, and if we are going to get you into the Lodge, I think we had better stick to Maragon's advice and work on your healing powers. It's Maragon you'll have to convince. He's the last word."

"I know," she said, wriggling her skinny knees against me. "And it scares me."

"Maybe it should," I said, trying to draw away a bit. "Your life won't be your own once you have been admitted to one of the degrees. But life in a Psi society has its compensations.

"Now, look at it this way," I went on. "Whether you meant to or not, you have staked your reputation as a PC on a prediction that our Grand Master will suffer a heart attack."

"He *will!*" she cut in.

"Sure. I even know a PC who agrees with you, in a misty sort of way. Now, think. You're a healer. If you can heal what you predict, it would make a big hit. Can you?"

Pheola's pointed features focused in a frown. "I'm sorry, Lefty," she admitted, "I don't even know what a heart attack is."

"That's what I thought," I said, getting up to switch on the hi-fi. It gave out soft music—lover's music, I guess it was meant to be. "But I'm a surgeon, you know that, don't you? And I can teach you something about hearts. The question in my mind is whether you can learn to handle what you know."

"I don't understand, Lefty," she said, holding out a hand to draw me back to her side on the sofa. I let her have me back.

"That's what I meant by our kind of love," I grinned at her. "Remember when you cured my arm the other night? You said you found the weak place in my head."

"That's what I did, darlin'."

"Can you find that place again, now that it's not weak?"

"Maybe," she decided.

"Try to," I suggested. I swung my feet around on the sofa and lay with my head in her lap. Pheola bent down over me and stroked my forehead with her fingers.

"Darlin' Billy!" she whispered. "Yes! *Yes!* I *can* feel it!"

I'll say she could. My thrashing right arm pretty near knocked her buck teeth out, and she retreated from my nervous system.

"You know what you did?" I asked, when the pain inside my head subsided.

"Not really, Lefty," she admitted.

"You have a kind of telekinesis. It's the lightest touch of all, but you applied it directly to my nerves. Perhaps you have some unconscious way of stimulating my synapses, making my nerve centers fire. I can't figure it out exactly. But my question is this, can you feel your way all around inside my body?"

She recoiled a little. "That sounds awful," she said.

"I thought you were in love with me," I insisted, looking up at her down-bent features. "Do you really have reservations about me?"

"No, Lefty. I love all of you."

"All right," I said, reaching up to stroke her cheek in time with the music. "See if you can feel your way—lightly, now—down the same path in my left arm."

She could, but not quite as lightly as I would have liked. We played with it until nearly midnight, by which time she had used what I can only call her sense of perception to feel her way through a good part of my nerves and viscera. Some of it was exquisitely painful, but from observing my flinching when she hurt me, Pheola pretty quickly found how to ignore the synapses that fired pain through my brain.

At last I raised my head from her lap. "You're doing great," I said. "Do you feel tired?"

She shook her head. "Just excited," she breathed. "What a funny way to get to know you!"

"Then we'll try one more thing, baby," I said. "Come on next door to my place. There's some stuff over there I want you to work with."

I thought Pheola might boggle about going into my apartment, but she came readily enough. I guess a PC has some pretty strong notions about what is going to happen next.

Just to keep the mood the same, I turned on my hi-fi and drew the loveseat up in front of the desk in my study. Pheola found a way to sit closer to me than I would have imagined possible while I fished a set of weights out of a drawer and laid them on the polished teak.

"Here's how it goes," I said to her, and TK'd the weights off the wood one at a time. Anybody else would have gotten bug-eyed, but Pheola just squinted to see better. Finally I made the big weight cross the room, go behind us, and then come back to its place on the desk. She had never seen a demonstration of trained ability, and to her it was so much magic.

"You've been doing the same thing, Pheola," I told her as I put an arm around her shoulder. "Only you've been doing it first to my nerves and later to my insides. Now let me see you do it to this little ball."

She looked at the little sphere of pith, similar to the ones that Evaleen Riley had used for practice, but nothing happened.

"I can't feel it," she protested, "It . . . It isn't *you,* Lefty. I'll never feel anything that isn't *you!*"

"Don't get mystical," I snapped. "You did some healing before you met me, and I don't suppose you were in love with every one you helped, were you?"

"Of course not."

"Try again."

"Nothing," she said, and the pith ball did not budge.

"Now watch this," I said, and popped the little ball into my mouth. "Feel for it," I insisted, pushing it into one cheek where it did not interfere with my speech.

She closed her eyes. "Where is it?" she demanded. "Did you swallow it, Lefty?"

"I either swallowed it or I kept it in my mouth," I said. "Feel for it!"

"There!" she gasped. "It's in your mouth!"

I rolled the piece of pith on to the top surface of my tongue and opened my mouth so that she could see it. "Agh!" I said, pointing at my tongue. I gestured again, and her face paled as the little ball left my tongue and floated in the air before my face. Suddenly her lift broke and it fell wetly onto my hand, in my lap.

I leaned over, put an arm around behind her neck and kissed her. It was a most sedate embrace. "There," I said, "that performance alone will get you into the Lodge. Now do you believe you're a TK?"

She gave a little shriek. A ladylike "Eek!"

"It's not that awful," I said. "A lot of Psi's can do it."

"You *kissed* me!" she said, paying no attention to my question.

"Sure," I agreed. "And you managed your first lift."

I picked the pith ball up in my fingers, showed it to her, and laid it on my palm.

"Feel my hand first," I suggested. "Then lift it over onto the desk."

She looked, wild-eyed, at the pith, shaking her head.

"I'll kiss you again," I suggested.

The little ball came away from my palm, floated erratically around, crossed over to my desk and dropped with a soft smack to the teak. She came to me like a tigress. I don't know why I expected a repetition of our first innocent kiss—I knew she had been married once.

I claim good marks for getting her back to her own apartment immediately.

For the balance of the week I saw very little of Pheola during the day. The hospital kept me busy with TK surgery, and I was practicing scalpel work with my newly-strong right arm, now that I had two hands to use. I'd be something more than a TK surgeon yet.

Pheola had a couple more sneaky sessions with Norty Baskins in the data-processing center, but for most of the time, she told me, she wandered around the part of the building the Lodge had retained for its own uses, meeting Psi's of various powers and more or less soaking up the flavor of life in the Manhattan Chapter. In the evenings we found a new place for dinner each night, and then came back to her place or mine to practice with the weights. Pheola would never be the bruiser that I was—so very few are—but she worked her grip up to several grams, which is quite respectable.

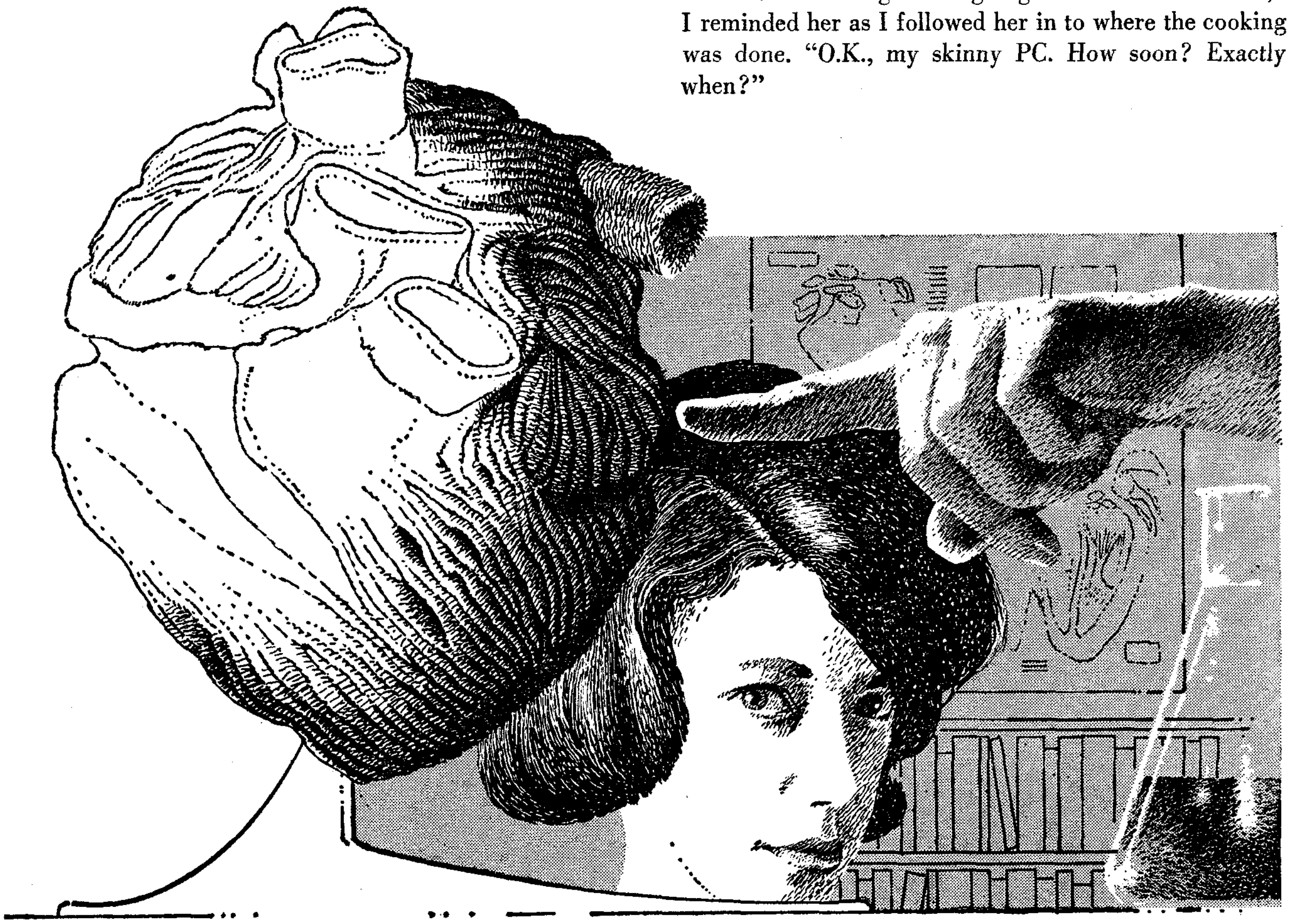
By that time I felt she was ready for a course of sprouts in the human heart. I used my drag at the hospital to bring her over with me for a cram course. We had a plastic model of a heart there, about four times life size, that was built in demountable layers for lecture and demonstration purposes. By the end of the second week, Pheola was able to work her sense of perception around inside my heart, based on what she had learned from the model, in surprisingly good shape.

"I guess you are in good health, Lefty," she told me late one night in her apartment. "Your valves feel just like the model, and your arteries are clear and good. I'm so glad for you."

"Clean living," I assured her. "And careful choice of grandparents. Now, my fat and sassy friend," I said. "I want some of your witchcraft." That fat part was something of a joke, for she would always be lean and rangy. But Pheola had put on a good ten pounds since we had first met. The weight was going to some rather pleasant spots to observe, and outside of her mess of buck teeth, she wasn't turning out to be such a bad-looking chicken. For one thing, she had race-horse legs, and that's never bad.

"Witchcraft, Lefty?" she said, getting up to go into her kitchen to pour some more coffee.

"You said Maragon was going to have a heart attack," I reminded her as I followed her in to where the cooking was done. "O.K., my skinny PC. How soon? Exactly when?"



She stopped pouring, set the percolator down and looked at me solemnly. "In two weeks, about."

"Hm-m-m," I said. "But it won't kill him?"

She picked up her cup and led me back to the sofa, sitting down before she answered me. "Not exactly," she said. "I don't want to talk about it."

That's what all the witches say when you try to get them to do any life-lining. "Have you told me all that you know?" I demanded.

Then she did a funny thing. She got up, went to the chest against the wall where her purse lay, and got out her glasses, racking them up on her long thin nose. She looked at me closely. "No, not all I know. And I don't aim to," she said. She made no move to come back to sit with me.

"I'm sorry," I said, "but this is Lodge business. I know that you're not a member yet, but you soon will be, and you might as well learn right now that you are subject to Lodge discipline. Tell me what you know."

"No!"

They all have to learn it sooner or later. I rammed a good stiff lift in under her heart, and saw her knees buckle. She gasped, and then the lights went out.

Pheola was beside me on the loveseat when my consciousness started to straggle back. Her hands were soothing my brow. That isn't where it had hurt. She had struck back, only twice as hard as I had managed. Fool around with somebody who had a good grip on *my* nervous system, would I? I was lucky to be alive.

"Oh, darlin'!" she gasped, as my eyes opened. "You hurt me so, and before I knew it I had done it to you! Forgive me, Billy Joe! I'll *never* do that again!"

"Better not," I groaned, trying to get my breath. "They'll carry me out in a pine box next time."

"I am so sorry," she said, beginning to cry.

"Then tell me," I said. "What else do you know?"

That only made her cry harder, but between sobs she got it out. "He won't die the first time," she said sniffling. "But the *next* attack will kill him."

"Soon after the first?"

She nodded. "A couple days," she said. "I wish you hadn't made me tell it."

"Good thing I did," I growled. "You're as nutty as a fruitcake. Maragon won't die. I've got it on good authority."

"I'm *right!*" she insisted.

I took it to Maragon the next morning. The city was shrouded in a low layer of cloud, and his glassed-in penthouse office was gloomy with the morning. He motioned me to sit down. I dragged one of his Bank of England chairs through the ankle-deep pile of his rug and set it down next to his big desk.

"I have a progress report on Pheola, Pete," I told him.

"That skinny one you brought back from Nevada, Lefty?"

I nodded. "She's not quite so skinny, thanks to my expense account," I said. "And she's ready to qualify."

"Not on PC," he said, hot at once.

"That remains to be seen, Pete. The lab has been tracking her predictions for better than two weeks now, and in a couple more weeks Norty will give us some stix on her scope, range and accuracy."

He glowered at me, his bushy brows down about his eyes. "I thought I told you to concentrate on her healing," he said.

"I have," I told him. "But I saw no harm in seeing what she is like with precognition," I said.

"Flat on her face, that's what she's like," he said testily. "One of these days I'll have to convince you that what I say around here goes, do you hear?"

"One of these days," I said. "But not when you're being a sour old goat. You're just sore at her because she said you'd have a heart attack."

"Nonsense!" he bristled.

"I've had Evaleen Riley doing a little PC work on you, too," I confessed, and saw his face get dark with anger. "Now hold your tongue, you old goat. I'm trying to help you," I cut in, to keep him from bellowing at me. "Evaleen is worried, too. But she's a little more cheerful than Pheola. She doesn't think you'll die."

"Well," he growled. "That's nice. I won't write my will."

"Stop acting like an old goat, you old goat," I snapped at him. "I'll give you a prediction of my own: You'll be sick enough to die, but we'll find a way to do something about it."

"Well, now *you're* a PC!" he huffed. I like to think I have a little, now and then. It's ever so short in range, and highly erratic, but I have had my flashes.

"Just one thing," I said to him. "As a surgeon who has done a lot of heart work, I want you in the heart clinic on the day these witches say you're going to be sick. It will certainly make a lot of us feel better, and the worst that can happen is that you can tell both those witches they don't know the right time."

I didn't get to first base. "Now I'll tell you something, Wally Bupp!" he said loudly. "I was fool enough to pay attention to what that witch of yours said, and I've had a complete checkup. The heart people can't find a thing the matter with my heart. The devil you say! I won't go near your hospital. Now get out of here and don't give me another word about the PC powers of that fraud."

I let a week go by after that, not quite able to figure out what I should do. One night, after a dinner that Pheola had cooked for me as part of her transparent scheme to convince me she was God's own gift to Lefty Bupp, I raised a question with her.

"You are still sure," I said, loading the dishwasher, "about Pete Maragon?"

"Yes," she said. "He'll have a heart attack.' "

"All right. Exactly when?"

"The nineteenth. Thursday," she said.

"We've got to pin point this thing," I said as we went back to her living room. "Do you think you are ready to do some serious diagnosis?"

"Of the Grand Master?" she asked me.

"Sure. I can get you into his office without too much trouble. What I want you to do is feel around inside his heart. The sawbones from the clinic can't find anything out of line, and I think you can. Can you PC that?"

She smiled at me. "Of course," she said. "You'll take me there in the morning."

I did, of course.

Maragon gave us an appointment when I assured him that I wanted to show him some aspects of Pheola's healing powers and that PC wasn't going to enter into the discussion. His spooky clairvoyant let us in with a knowing smile and we found the old goat pouring over some papers in front of him on the big slab of walnut.

He was really quite nice to Pheola. "Well, well, young woman," he said, "Lefty tells me that you are coming along."

"I hope so, Mr. Maragon," she said.

"Well, Lefty," he said, after he had shown us both into the handsome chairs he had drawn up in front of his desk, "you were going to have Pheola give me some kind of a demonstration."

"Sure," I said. "First off I want you to know that she can qualify as a TK. Her healing powers are a subtle form of that. But as proof, she'll give a demonstration with weights."

I drew the carrying case from my pocket and laid four pith balls on his desk, as well as a ten-gram standard TK weight.

"Ten grams?" he said, interested.

"Maybe," I grinned. "We haven't tried this outside our own company. Pretty big emotional quotient here, you know."

He shook his head. "It has to be reproducible, Lefty," he said, but in a kindly tone. "Let me see it, Pheola."

She was really pretty good, and the pith balls behaved quite well. The first time around, the ten-gram weight stopped her cold, but by laying it on my palm, she got a good grip and thereafter was able to make it perform.

"Very nicely done," the old goat grumbled. He hadn't expected anything of the kind. But I was only half through with him.

"Now," I said. "The more important part of the demonstration. Do you object to a little minor pain?"

"I certainly do," he growled, bringing his bushy brows down.

"Well, the only way you can tell that Pheola is able to employ her TK within you is to give you a little sensation. It will only be some twinges," I said.

He wanted to argue about it, and I dragged the conversation out until I felt a little tug on my ear. Pheola had completed her scan of Maragon's heart.

"Oof!" he said as she hit him lightly in the diaphragm. Then she made his hands jump, first one and then the other. None of it felt real good, I could see, from the flinching and lip biting that was going on across the desk.

"That's enough!" he exclaimed as she went to work on his throat. His hand flew up to massage his larynx. "Quite convincing, young woman. But what is it good for?"

I laughed at him. "What are most Psi powers good for?" I asked him. "All that we require for membership is that a person be able to display them under standardized conditions."

"Yes," he agreed. "Yes, I guess that's so. Well, I gather you'll be ready to go into your act at the next Chapter Meeting, then?"

Pheola nodded. "I hope so," she said.

"I do, too," the old goat agreed, getting in the last word. "It would be nice if you could figure out what to do with your ability to snap my nerve-strings!"

We were silent in the ride down the elevator to our apartments. I took the chance that Pete wasn't having us peeped, and spoke as soon as we were in my study.

"What did you find out, Pheola?" I asked her.

"I could feel something, Lefty," she said. "When you had the heart model over at the hospital, you showed me the coronary artery, you remember?"

"Yes."

"There are two little bumps in his artery, one about three times as large as the other."

"Bumps?" I said, frowning. "I'm not sure I know what that means, Pheola."

"Well, remember how I told you that your own arteries were nice and clear?"

I nodded.

"His coronary artery isn't like that. It's sort of caked and crusty. And I think some of that coating has broken away in a couple spots, and they are like scabs on the sores, only they aren't hard."

This was as close to a classic description of coronary clotting as I figured I would get in nontechnical terms. What her words mean to me was that Maragon's coronary artery, as in many men his age, was somewhat choked with deposits of cholesterol. In a couple places the deposit had broken away, exposing the raw surface of the artery. But instead of scar tissue forming to heal the open spot, clotting had taken place. And if either of those clots broke loose, and plugged one of the minor arteries in the heart, we'd see a coronary attack as that part of the muscle was starved for blood and died.

The information was useless, in a medical sense. There is no surgery for the condition. There was, however, something untried that could possibly be done.

"Where is it going to happen?" I asked her. "The heart attack?"

"In the hospital," she said.

"And what will I have you do?"

She frowned for a moment. "You want me to cure it," she said. "I'm not sure I understand how."

"I do," I said. "That's enough. From here on I just want to work a two-horse parlay. The old goat can't help but be convinced by the demonstration you are going to give him. The thing that I want is for him to agree that your PC powers exist at the same time. We'll whipsaw him good."

In the morning, after the first surgery was over, I went downstairs to the heart clinic. Doc Swartz was in his office. He's the best heart man at Memorial, and I figured that Maragon would have gone to him.

"What's up, Lefty?" he asked as I came in to his office and shut the door against some of the smells of the hospital. "How is your scalpel work coming?"

"I'll be doing my own cutting any day now," I said. "I came on another errand."

"So?"

"Did you give Maragon's heart a checkup in the last couple weeks?" I asked.

"None of your business," he smiled. "You know I can't talk about my patients."

"This is Lodge business, Doc," I protested. "I know you aren't a Psi, and thus aren't subject to our discipline, but I think it's time we exchanged some information."

"Exchanged?"

I nodded. "You know—or do you know—that I've been working with a girl, giving her some training."

"No," he said. "I don't hear much about the Lodge. You folks are pretty tight-mouthed around Normals."

"Sure," I said, not wanting to appear uncomfortable about it. Doc was all right—he never showed any resentment that he didn't have Psi powers. Quite sensibly, he was satisfied with his own normal skills. "Well, this girl is a very delicate telekinetic," I told him. "She is the one who brought my right arm back to life. She's good."

"She must be," he agreed. "I know that stumped every neurologist over here."

"Right," I said. "She has been exploring the insides of Maragon's heart."

"What!"

"Sense of perception—light TK touch—anything you want to call it. I can get her to demonstrate, if you insist. But you can take my word for it. She can feel her way around inside your body the way you can feel your way around the outside."

"And what is her diagnosis?" he said, irritated now. *He* was the heart expert.

I told him about the clots, and he nodded as he got the picture. "A classic description," he agreed. "But what can we do about it? Clots like that are next to impossible to break down. If they flake away in too big a chunk, they can kill."

"I know," I agreed. "But there is more to the story. Pheola is a precog as well. She says that one of the clots will break loose on the nineteenth, and that Maragon will have an attack. I want to make sure he is over here, in a hospital bed, with you on hand, when it happens."

"You Psi's!" he said. "Do I have to take this seriously, that this woman can tell the future?"

"Yes, you do," I said. "One of our other PC's confirms it."

"That just doubles the creepiness," he said. "How can I manage it, even if it's true?"

"Tell the old goat that more detailed examination of his EKG makes you want him in for observation. Even Maragon listens to doctors. Tell him whatever it takes to get him to bed that morning. You might even bring him in the night before."

Doc Swartz shrugged. "I guess I'll have to play your game," he decided. "But this had better be good!"

I never did learn what Doc Swartz told the Grand Master, or how much the old goat suspected. But I learned from my hospital sources that Maragon was scheduled to enter the heart clinic the night of the eighteenth for "tests."

I let Pheola set the timing for us, and we showed up at his room around ten on the morning of the nineteenth, shortly before Pheola predicted his heart attack would occur.

The old goat was sitting up in bed as he was being examined by Doc Swartz and another sawbones. Leads from the EKG led from his chest and wrists. He fired one scorching glance at the two of us.

"What is this?" he demanded. "Get out of here!"

I shook my head. "Not me," I said. "I'm an accredited surgeon at this hospital."

"What about her?" he growled, pushing Swartz away from him. "Get that witch out of here!"

"A diagnosis is about to be made," I said, bringing Pheola to his side. "And it would help if you shut up for a couple minutes."

He turned angrily to Swartz, but I had him pretty well cowed, and he shook his head. "We could use some help, Mr. Maragon," he said. "There are some anomalies in your EKG that this lady's Psi powers may help us resolve. I should think that you, of all people, would want . . ."

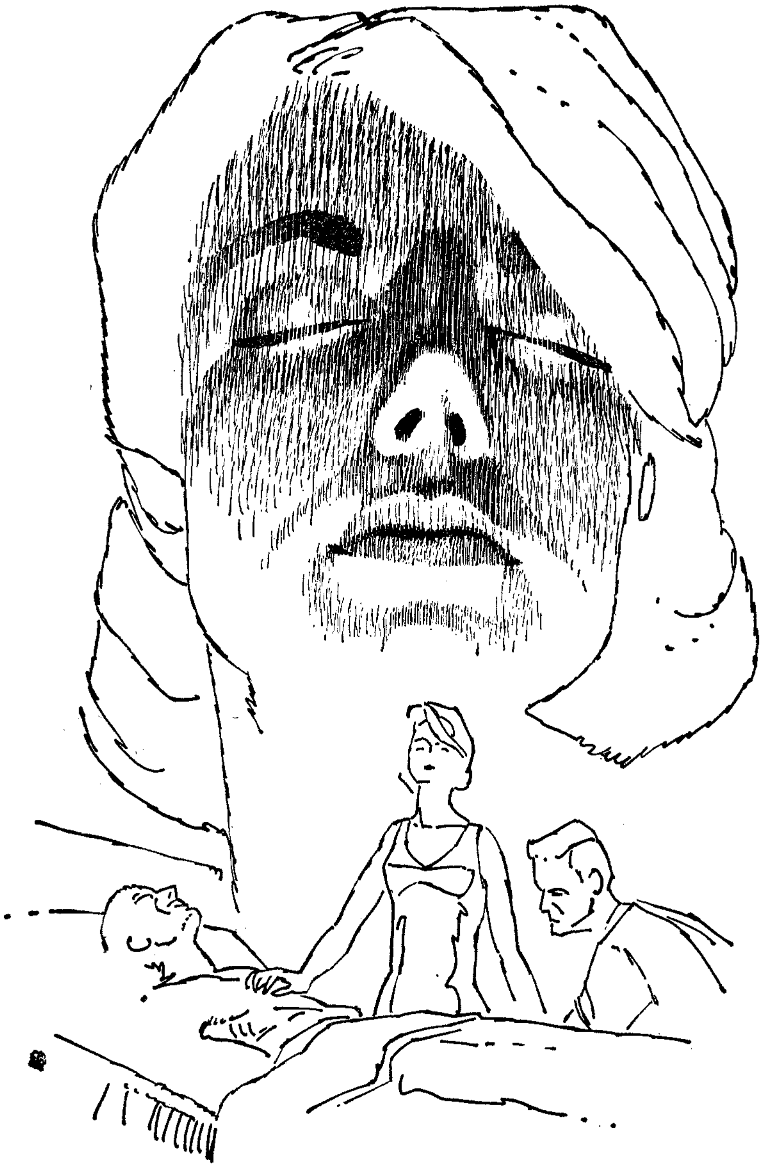
"Oh, shut up!" he grumped. "You are ganging up on me. Go ahead," he snapped at Pheola. "And get it over with!"

His gown had been pushed down from his shoulders for Doc Swartz's stethoscope work, and the mat of graying hair on his chest was exposed. Pheola laid a hand on his chest—she seemed to have a better feel after a touch, just as I do with the weights. There was a dead silence in the room as she stood there, eyes closed, and slowly ran her fingers over his rib cage. After some minutes her eyes opened, and she came back to my side.

"Still the same," she said. I nodded and looked over at Swartz.

"Well," Maragon growled, "have you ill-assorted characters agreed on a diagnosis?"

"In a sense," I told him. "It's nothing that every doctor in this room couldn't have guessed at without bothering



to examine you. You're sixty years old, and you've got sixty-year-old arteries. That's all."

"Great," he said, reaching for the thin blanket that covered his chunky legs. "Then I can . . ."

He stopped, and a spasm crossed his face.

It went away, and he slowly turned to face Pheola, a sort of angry consternation coloring his features. "You witch!" he whispered. Then the pain hit him much harder. "My arm!" he said.

There were doctors around him in a flash. He was still wired to the EKG machine. "That's it!" the technician said. "The T-waves have gone inverted!"

That meant damage—typical coronary damage. They chased us out, and we sat in a kind of death watch in a waiting room, while Pheola cried softly.

"Stop it," I said after a while. "Simply because you could foretell it doesn't mean you caused it!" But it was no use.

In the afternoon Doc Swartz came out to tell us that the attack had been mild. "Do you suppose Pheola could make another diagnosis?" he asked. "We'd like to know exactly what is going on in there."

I looked over at her. Her eyes were red, and her pointed nose showed too frequent use of her handkerchief, but she nodded, and followed us back to Maragon's room.

Maragon was resting quietly, and didn't have a word to say as Pheola ran her hands carefully over his chest. It was the only time I could remember when the old goat hadn't had some sharp word for me.

Pheola opened her eyes and led us out into the corridor. "The smaller bump is gone," she said. "The other one feels very soft. It sort of sways every time his heart beats."

"Absolute quiet," was Doc Swartz's answer. "There's a chance that clot will dwindle, erode, and harden up. But obviously we want to keep him as quiet as possible to make that take place."

"You had better know," I said quietly. "Pheola predicts it will break loose in a couple days and kill him."

"How accurate is she?" he said, looking sideways at where my witch stood crying.

"We'll get some ideas on that yet today," I told him. "Evaleen Riley, another one of our PC's, doesn't agree on the death part, and she's pretty good."

I turned to Pheola. "We had better go over to see Norty Baskins," I told her. "We *have* to know if you're right or not."

"I'm right," she said, wiping her eyes.

Norty was ready for us. "Well," he said, as we came in, "Lefty was right about you, Pheola. He said you were a rare one, and so you are."

"I *was* right, wasn't I?" she said, beginning to feel good and bad at the same time.

"Some of the time," Norty agreed. "When you are right, you are the sharpest PC this lab has ever tested. But that's only a rather small part of the time. When you're wrong, you're really wrong."

"So he may *not* die!" I said. "What did I tell you?"

"Show me!" she demanded.

"All right," Norty said. "Take a look at this. You remember giving me all those predictions about temperature and barometric pressures?"

"Yes," she said.

"We've drawn a couple moving weather maps," Norty explained. "Just the pressures on these. They cover the thirty-day period for which you PC'd. One of the maps shows the actual isobars as they were recorded by the Weather Bureau. The other moving map is the same isobars as predicted by you, Pheola. We'll run the two maps simultaneously on a screen. The black lines are the actual readings. The red lines are your predictions."

It was sort of like watching an animated cartoon. The map started with an overlap of red and black and then you could see each high and low pressure area work its way across the country and out to sea. But there was a difference. After a couple hours, on their time scale, Pheloa's map differed from the actual, and the difference grew greater for a while, and then narrowed. Suddenly the red and black lines were identical.

The cycle repeated several times in the thirty-day period.

"What you see," said Norty, "is that she is right for a few hours and then wanders off, sometimes for several days, but wanders back and gets right again. The timing of when she is right is rather random—there's no regular periodicity to it, and as a result, we can't see how to predict when she is going to be right and when she is not."

"I have a thought for you," I said, when Norty had shut off the projection. "It's sort of like two sine waves that intersect now and then. One of them has bigger amplitude than the other, or their periodicity is different. Can't you feed this dope to your computers and find out what kinds of curves would represent the coincidences?"

He gave me a suffering look. "Don't you suppose I tried that? I get indeterminate solutions—the machine can't find any curves that answer the data."

Pheola got her own answers out of that. "Then you don't know whether I am right about Maragon or not."

"We know that you may not be right, that's something," I reminded her. "Come on up to the apartment. This calls for some thinking."

Pheola protested that. "Please, Lefty," she said, "this has got me all shaken up. I'd like to be alone for a while. Will you come and get me for dinner?"

"Sure," I said.

Pheola was in better spirits by dinner time, and didn't exactly pick at her food. At any rate, she was ready to talk when we finally got back to my apartment.

"Did you understand what I said to Norty about the sine waves, Pheola?" I asked her.

She shook her head. Her education had not proceeded to calculus, and her trig was too far behind her for quick recollection of what sine waves were.

I drew some sketches of overlapping sine waves for her to explain what I thought was going on. "You are making predictions on this one path, and actual events are on another path, do you see?" I said. "When the two paths cross, the events that you predict and actual events are the same, and at those times you're right."

"I know," she said. "I thought about it all afternoon. I didn't want to say it to Norty, but when I was giving him all those numbers, there came times when it was a little fuzzy, and I wasn't so sure."

"And what did you do?"

"I guessed—because it would clear up right after that, and I'd be sure again."

"Can you explain the fuzziness?" I prodded.

She shrugged. "It's like a fork in the road," she said, holding her two index fingers next to each other. "And there are *two* pictures for a while."

You may not have noticed it, but your index finger is not straight. It curves in toward your middle finger so that you can hold all the tips together if you want to. And when Pheola laid her two index fingers together, they curved away from each other at their tips. I got a flash and went immediately to my phone.

"Hello," I said to the O-operator cartoon. "Get Norty Baskins. If he's asleep, wake him."

Norty was quite upset about being awakened.

"I have a suggestion for your machine," I said to him. "Try it in three dimensions. Instead of sine waves, visualize it as two coil springs that are all snarled up in each other. Each has a different pitch, perhaps different diameter. But at certain points the coils touch each other, and at those times she is right."

"In the morning?" he said weakly, rubbing his eyes.

"Nonsense," I said. "We'll meet you down there."

The trick in getting decent answers out of computers is to ask them sensible questions. It took us nearly until dawn to get the question right. And then we got a very sweet answer. There were two helices all right, as an explanation of how Pheola could be right and then wrong. I had my own idea about what the helices signified, but that was unimportant beside the fact that we were now able to predict at what times in the future the helices would coincide. It was at the time of their intersection that Pheola would be right in her predictions.

We did a little extrapolation. "Well," I said to her, "it's nice to know that you're going to be wrong tomorrow and the next day. Maragon isn't going to die."

"I'm sorry . . . oh, I don't mean that!" she apologized. "But I did so want to be right, and now I know I'm just what he said, a fake!"

"Not all of the time," I reminded her. "But this gives me confidence in what I want you to do at the hospital today."

We grabbed a little shut-eye. Fatigue cuts into TK powers as much as it cuts into any other human ability, and I wanted Pheola to be at her best. But around lunchtime we dropped over to see Doc Swartz, and I explained to him what I thought Pheola could do for Maragon.

"I doubt that clot has had time to get any better," he said. "If Pheola examines him now and finds it as big as ever, and still soft and flexible, I think we should entertain your idea."

Pheola made a trip up to Maragon's room, and returned. "Just the same," she said. "He looks so tired."

"He's not so bad, better than he looks," Swartz said stoutly. "And you can still feel the clot?"

"Yes."

He turned to me. "Pheola," I said. "Now the question is whether you can help break it up. Maragon's blood stream is not eroding the clot. Perhaps it has a sort of envelope of firmer fibrin around it, something that keeps it from breaking down. The question is whether you are sensitive enough, and have enough control, to get a good grip on the clot, and start breaking it up by tearing away at its surface. It certainly has very little mechanical strength, and you have several grams of TK in the lab. What do you think?"

The whole idea scared the devil out of her, but we went back to Maragon's room together, where she felt for the clot with a new outlook on the problem. After some minutes she nodded, and we went out in the corridor to put our heads together.

"I think I can do it, Lefty," she said. "But what if something goes wrong?"

"It won't," I said. "Evaleen Riley says that he isn't going to die, and I believe her."

"O.K.," said Doc Swartz. "I'll put it up to him."

"I'd put it this way," he said to Maragon, when we had gone back into his room. "We can keep you here in bed for a while, but sooner or later you are going to feel well enough to leave, and we won't be able to make you stay. The first time you do anything that gets your heart going a little faster than it does lying here, that clot will break loose and kill you."

"The big thing," I reminded him, "is that Evaleen can't find that you are going to die. That argues that we are going to succeed."

"And this witch?" Maragon asked, moving his head slightly to indicate Pheola.

"No reading at all for the next couple days," I said. "She's a periodic PC."

"I'll bet!" he said. He was beginning to feel better. "Well, go ahead."

Pheola went over to his side, carefully pulled the blanket down, and with help from the nurse, drew his gown down from over his hairy chest. She laid hands on him and stood there for many minutes with her eyes closed.

"I'm doing it," she said at last. "I have sort of peeled off the top, and I can shred it away, a little at a time."

"How long will this take?" Maragon grumbled, already beginning to sound more like his old self.

"A couple hours," she said. "And hush!"

At Doc Swartz's suggestion I stayed there with Pheola. "She depends on you, Lefty," he whispered.

Toward the end of the two hours they were giving Pete anti-coagulant injections. "No sense letting another clot form just as soon as Pheola breaks up this one," Swartz said. "This way we have a good chance that the open wound will form some scar tissue. Sure, the artery will have lost some flexibility, but the danger of another coronary will be past."

They consider the first six days the danger time. At the end of that period Pheola confirmed that the open sore was gone and that both areas of clotting had been repaired by Maragon's body's own restorative processes. They let him out of the hospital at the end of another week.

I went to see him with Pheola the first day that he spent back at his desk. He didn't seem in any way changed by his ordeal. I suppose, when you live as close to all the manifestations of Psi as Pete does, that very little can surprise you.

"Well, young woman," he said to her, getting up to bring her one of his Bank of England chairs. "The sawbones tell me I have you to thank for my life. And better than that, they feel there are a number of delicate TK's around who can be trained in your diagnostic techniques. This ought to be quite a thing in preventing coronaries."

"Thank you," she said. "I was so frightened that I would let Lefty down a second time."

"A second time?" he said.

"I was wrong about your dying," she reminded him. "I'm wrong so much in my predictions. I guess I'll just have to forget about that."

He looked over at me. "What about it, Lefty? Can we consider Pheola a PC, or is she merely a TK?"

I grinned at him. "She is probably the most accurate PC in the Lodge," I said to him. His eyebrows went up, and Pheola shook her head.

"Accurate," I repeated, "if you'll let me define accuracy."

"Define it."

"According with some definite series of future events," I said. "That's my definition."

"But I thought you said she's only right now and then," Maragon protested.

"I said a 'definite series of events.' Unfortunately, the series of events that Pheola predicts are in a different space-time continuum," I explained. "You have to consider that we are passing through time in a helix. The events that Pheola predicts are in a different helix. The two helices are all snarled together, and at certain times our coil of time intersects her coil. Then she's right, because events in the two continua are the same. We can predict when she's going to be right for our helix, which is a small part of the time, but that part we can use."

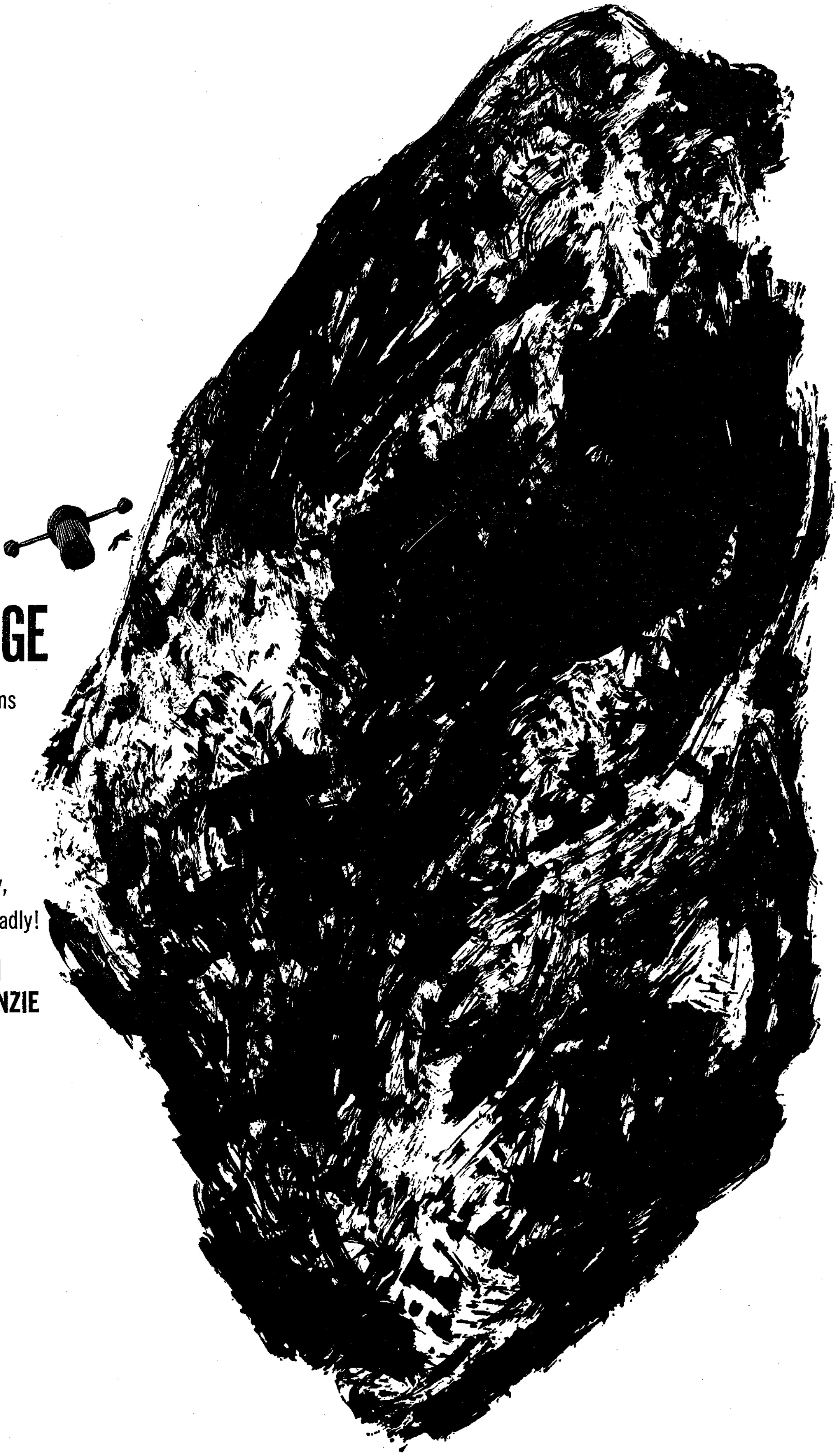
He gave me an owlish look. "Philadelphia lawyer," he said. "No other PC is geared in to the same space-time continuum that Pheola predicts, I suppose, so that means there is no way to test whether she was right or wrong about events in that other time."

"None," I agreed. "But my theory is the only one that holds any water, so far. It works. It permits us to predict when Pheola can predict. I claim she qualifies for the Tenth Degree."

"Maybe so," he said. "Well, young woman, welcome to Membership in the Lodge." He held out his hand, which she took. "Tell me," he went on, "what's the next big thing you predict?"

Pheola smiled over at me. "Lefty is going to take me to the orthodontist this afternoon," she said. "He wants me to have my teeth straightened before we get married."

I'll say one thing for her, right or wrong, she never got off the loud pedal on *that* prediction. ■



THIN EDGE

There are inventions
of great value
that one type of
society can use—
and that would,
for another society,
be most nastily deadly!

**BY JOHNATHAN
BLAKE MAC KENZIE**

ILLUSTRATED BY
JOHN SCHOENHERR

I

"Beep!" said the radio smugly. *"Beep! Beep! Beep!"*

"There's one," said the man at the pickup controls of tugship 431. He checked the numbers on the various dials of his instruments. Then he carefully marked down in his log book the facts that the radio finder was radiating its beep on such-and-such a frequency and that that frequency and that rate-of-beep indicated that the asteroid had been found and set with anchor by a Captain Jules St. Simon. The direction and distance were duly noted.

That information on direction and distance had already been transmitted to the instruments of the tugship's pilot. "Jazzy-o!" said the pilot. "Got 'im."

He swiveled his ship around until the nose was in line with the beep and then jammed down on the forward accelerator for a few seconds. Then he took his foot off it and waited while the ship approached the asteroid.

In the darkness of space, only points of light were visible. Off to the left, the sun was a small, glaring spot of whiteness that couldn't be looked at directly. Even out here in the Belt, between the orbits of Mars and Jupiter, that massive stellar engine blasted out enough energy to make it uncomfortable to look at with the naked eye. But it could illuminate matter only; the hard vacuum of space remained dark. The pilot could have located the planets easily, without looking around. He knew where each and every one of them were. He had to.

A man can navigate in space by instrument, and he can take the time to figure out where every planet ought to be. But if he does, he won't really be able to navigate in the Asteroid Belt.

In the Nineteenth Century, Mark Twain pointed out that a steamboat pilot who navigated a ship up and down the Mississippi had to be able to identify every landmark and every changing sandbar along the river before he would be allowed to take charge of the wheel. He not only had to memorize the whole river, but be able to predict the changes in its course and the variations in its eddies. He had to be able to know exactly where he was at every moment, even in the blackest of moonless nights, simply by glancing around him.

An asteroid man has to be able to do the same thing. The human mind is capable of it, and one thing that the men and women of the Belt Cities had learned was to use the human mind.

"Looks like a big 'un, Jack," said the instrument man. His eyes were on the radar screen. It not only gave him a picture of the body of the slowly spinning mountain, but the distance and the angular and radial velocities. A duplicate of the instrument gave the same information to the pilot.

The asteroid was fairly large as such planetary debris went—some five hundred meters in diameter, with a mass of around one hundred seventy-four million metric tons.

Within twenty meters of the surface of the great mountain of stone, the pilot brought the ship to a dead stop in relation to that surface.

"Look like she's got a nice spin on her," he said. "We'll see."

He waited for what he knew would appear somewhere near the equator of the slowly revolving mass. It did. A silvery splash of paint that had originally been squirted on by the anchor man who had first spotted the asteroid in order to check the rotational velocity.

The pilot of the space tug waited until the blotch was centered in the crosshairs of his peeper and then punched the timer. When it came around again, he would be able to compute the angular momentum of the gigantic rock.

"Where's he got his anchor set?" the pilot asked his instrument man.

"The beep's from the North Pole," the instrument man reported instantly. "How's her spin?"

"Wait a bit. The spot hasn't come round again yet. Looks like we'll have some fun with her, though." He kept three stars fixed carefully in his spotters to make sure he didn't drift enough to throw his calculations off. And waited.

Meanwhile, the instrument man abandoned his radar panel and turned to the locker where his vacuum suit waited at the ready. By the time the pilot had seen the splotch of silver come round again and timed it, the instrument man was ready in his vacuum suit.

"Sixteen minutes, forty seconds," the pilot reported. "Angular momentum one point one times ten to the twenty-first gram centimeters squared per second."

"So we play Ride 'Em Cowboy," the instrument man said "I'm evacuating. Tell me when." He had already poised his finger over the switch that would pull the air from his compartments, which had been sealed off from the pilot's compartment when the timing had started.

"Start the pump," said the pilot.

The switch was pressed, and the pumps began to evacuate the air from the compartment. At the same time, the pilot jockeyed the ship to a position over the north pole of the asteroid.

"Over" isn't quite the right word. "Next to" is not much better, but at least it has no implied up-and-down orientation. The surface gravity of the asteroid was only two millionths of a Standard Gee, which is hardly enough to give any noticeable impression to the human nervous system.

"Surface at two meters," said the pilot. "Holding."

The instrument man opened the outer door and saw the surface of the gigantic rock a couple of yards in front of him. And projecting from that surface was the eye of an eyebolt that had been firmly anchored in the depths of the asteroid, a nickel-steel shaft thirty feet long and eight inches in diameter, of which only the eye at the end showed.

The instrument man checked to make sure that his safety line was firmly anchored and then pushed himself across the intervening space to grasp the eye with a space-gloved hand.

This was the anchor.

Moving a nickel-iron asteroid across space to nearest processing plant is a relatively simple job. You slap a powerful electromagnet on her, pour on the juice, and off you go.

The stony asteroids are a different matter. You have to have something to latch on to, and that's where the anchor-setter comes in. His job is to put that anchor in there. That's the first space job a man can get in the Belt, the only way to get space experience. Working by himself, a man learns to preserve his own life out there.

Operating a space tug, on the other hand, is a two-man job because a man cannot both be on the surface of the asteroid and in his ship at the same time. But every space tug man has had long experience as an anchor setter before he's allowed to be in a position where he is capable of killing someone besides himself if he makes a stupid mistake in that deadly vacuum.

"On contact, Jack," the instrument man said as soon as he had a firm grip on the anchor. "Release safety line."

"Safety line released, Harry," Jack's voice said in his earphones.

Jack had pressed a switch that released the ship's end of the safety line so that it now floated free. Harry pulled it towards himself and attached the free end to the eye of the anchor bolt, on a loop of nickel-steel that had been placed there for that purpose. "Safety line secured," he reported. "Ready for tug line."

In the pilot's compartment, Jack manipulated the controls again. The ship moved away from the asteroid and yawed around so that the "tail" was pointed toward the anchor bolt. Protruding from a special port was a heavy-duty universal joint with special attachments. Harry reached out, grasped it with one hand, and pulled it toward him, guiding it toward the eyebolt. A cable attached to its other end snaked out of the tug.

Harry worked hard for some ten or fifteen minutes to get the universal joint firmly bolted to the eye of the anchor. When he was through, he said: "O.K., Jack. Try 'er."

The tug moved gently away from the asteroid, and the cable that bound the two together became taut. Harry carefully inspected his handiwork to make sure that everything had been done properly and that the mechanism would stand the stress.

"So far so good," he muttered, more to himself than to Jack.

Then he carefully set two compact little strain gauges on the anchor itself, at ninety degrees from each other on the circumference of the huge anchor bolt. Two others were already in position in the universal joint itself. When everything was ready, he said: "Give 'er a try at length."

The tug moved away from the asteroid, paying out the cable as it went.

Hauling around an asteroid that had a mass on the order of one hundred seventy-four million metric tons required adequate preparation. The nonmagnetic stony asteroids are an absolute necessity for the Belt Cities. In order to live, man needs oxygen, and there is no trace of an atmosphere on any of the little Belt worlds except that which Man has made himself and sealed off to prevent it from escaping into space. Carefully conserved though that oxygen is, no process is or can be one hundred per cent efficient. There will be leakage into space, and that which is lost must be replaced. To bring oxygen from Earth in liquid form would be outrageously expensive and even more outrageously inefficient—and no other planet in the System has free oxygen for the taking. It is much easier to use Solar energy to take it out of its compounds, and those compounds are much more readily available in space, where it is not necessary to fight the gravitational pull of a planet to get them. The stony asteroids average thirty-six per cent oxygen by mass; the rest of it is silicon, magnesium, aluminum, nickel, and calcium, with respectable traces of sodium, chromium, phosphorous manganese, cobalt, potassium, and titanium. The metallic nickel-iron asteroids made an excellent source of export products to ship to Earth, but the stony asteroids were for home consumption.

This particular asteroid presented problems. Not highly unusual problems, but problems nonetheless. It was massive and had a high rate of spin. In addition, its axis of spin was at an angle of eighty-one degrees to the direction in which the tug would have to tow it to get it to the processing plant. The asteroid was, in effect, a huge gyroscope, and it would take quite a bit of push to get that axis tilted in the direction that Harry Morgan and Jack Latrobe wanted it to go. In theory, they could just have latched on, pulled, and let the thing precess in any way it wanted to. The trouble is that that would not have been too good for the anchor bolt. A steady pull on the anchor bolt was one thing: a nickel-steel bolt like that could take a pull of close to twelve million pounds as long as that pull was along the axis. Flexing it—which would happen if they let the asteroid precess at will—would soon fatigue even that heavy bolt.

The cable they didn't have to worry about. Each strand was a fine wire of two-phase material—the harder phase being borazon, the softer being tungsten carbide. Winding these fine wires into a cable made a flexible rope that was essentially a three-phase material—with the vacuum of space acting as the third phase. With a tensile strength above a hundred million pounds per square inch, a half-inch cable could easily apply more pressure to that anchor than it could take. There was a need for that strong cable: a snapping cable that is suddenly released from a tension of many millions of pounds can be dangerous in the extreme, forming a writhing whip that can lash through a spacesuit as though it did not exist. What damage it did to flesh and bone after that was of minor importance; a man who loses all his air in explosive decompression certainly has very little use for flesh and bone thereafter.

"All O.K. here," Jack's voice came over Harry's headphones.

"And here," Harry said. The strain gauges showed nothing out of the ordinary.

"O.K. Let's see if we can flip this monster over," Harry said, satisfied that the equipment would take the stress that would be applied to it.

He did not suspect the kind of stress that would be applied to him within a few short months.

II

The hotel manager was a small-minded man with a narrow-minded outlook and a brain that was almost totally unable to learn. He was, in short, a "normal" Earthman. He took one look at the card that had been dropped on his desk from the chute of the registration computer and reacted. His thin gray brows drew down over his cobralike brown eyes, and he muttered, "Ridiculous!" under his breath.

The registration computer wouldn't have sent him the card if there hadn't been something odd about it, and odd things happened so rarely that the manager took immediate notice of it. One look at the title before the name told him everything he needed to know. Or so he thought.

The registration robot handled routine things routinely. If they were not routine, the card was dropped on the manager's desk. It was then the manager's job to fit everything back into the routine. He grasped the card firmly between thumb and forefinger and stalked out of his office. He took an elevator down to the registration desk. His trouble was that he had seized upon the first thing he saw wrong with the card and saw nothing thereafter. To him, "out of the ordinary" meant "wrong"—which was where he made his mistake.

There was a man waiting impatiently at the desk. He had put the card that had been given him by the registration robot on the desk and was tapping his fingers on it.

The manager walked over to him. "Morgan, Harry?" he asked with a firm but not arrogant voice.

"Is this the city of York, New?" asked the man. There was a touch of cold humor in his voice that made the manager look more closely at him. He weighed perhaps two-twenty and stood a shade over six-two, but it was the look in the blue eyes and the bearing of the man's body that made the manager suddenly feel as though this man were someone extraordinary. That, of course, meant "wrong."

Then the question that the man had asked in rebuttal to his own penetrated the manager's mind, and he became puzzled. "Er . . . I beg your pardon?"

"I said, 'Is this York, New?' " the man repeated.

"This is New York, if that's what you mean," the manager said.

"Then I am Harry Morgan, if that's what *you* mean."

The manager, for want of anything better to do to cover his confusion, glanced back at the card—without really looking at it. Then he looked back up at the face of Harry Morgan. "Evidently you have not turned in your Citizen's Identification Card for renewal, Mr. Morgan," he said briskly. As long as he was on familiar ground, he knew how to handle himself.

"Odd's Fish!" said Morgan with utter sadness, "How did you know?"

The manager's comfortable feeling of rightness had returned. "You can't hope to fool a registration robot, Mr. Morgan," he said "When a discrepancy is observed, the robot immedately notifies a person in authority. Two months ago, Government Edict 7-3356-Hb abolished titles of courtesy absolutely and finally. You Englishmen have clung to them for far longer than one would think possible, but that has been abolished." He flicked the card with a finger. "You have registered here as 'Commodore Sir Harry Morgan'—obviously, that is the name and antisocial title registered on your card. When you put the card into the registration robot, the error was immediately noted and I was notified. You should not be using an out-of-date card, and I will be forced to notify the Citizen's Registration Bureau."

"Forced?" said Morgan in mild amazement. "Dear me! What a terribly strong word."

The manager felt the hook bite, but he could no more resist the impulse to continue than a cat could resist catnip. His brain did not have the ability to overcome his instinct. And his instinct was wrong. "You may consider yourself under arrest, Mr. Morgan."

"I thank you for that permission," Morgan said with a happy smile. "But I think I shall not take advantage of it." He stood there with that same happy smile while two hotel security guards walked up and stood beside him, having been called by the manager's signal.

Again it took the manager a little time to realize what Morgan had said. He blinked. "Advantage of it?" he repeated haphazardly.

Harry Morgan's smile vanished as though it had never been. His blue eyes seemed to change from the soft blue of a cloudless sky to the steely blue of a polished revolver. Oddly enough, his lips did not change. They still seemed to smile, although the smile had gone.

"Manager," he said deliberately," if you will pardon my using your title, you evidently cannot read."

The manager had not lived in the atmosphere of the Earth's Citizen's Welfare State as long as he had without knowing that dogs eat dogs. He looked back at the card that had been delivered to his desk only minutes before and this time he read it thoroughly. Then, with a gesture, he signaled the Security men to return to their posts. But he did not take his eyes from the card.

"My apologies," Morgan said when the Security police had retired out of earshot. There was no apology in the tone of his voice. "I perceive that you *can* read. Bully, may I say, for you." The bantering tone was still in his

voice, the pseudo-smile still on his lips, the chill of cold steel still in his eyes. "I realize that titles of courtesy are illegal on earth," he continued, "because courtesy itself is illegal. However, the title 'Commodore' simply means that I am entitled to command a spaceship containing two or more persons other than myself. Therefore, it is not a title of courtesy, but of ability."

The manager had long since realized that he was dealing with a Belt man, not an Earth citizen, and that the registration robot had sent him the card because of that, not because there was anything illegal. Men from the Belt did not come to Earth either willingly or often.

Still unable to override his instincts—which erroneously told him that there was something "wrong"—the manager said: "What does the 'Sir' mean?"

Harry Morgan glowed warmly. "Well, now, Mr. Manager, I will tell you. I will give you an analogy. In the time of the Roman Republic, twenty-one centuries or so ago, the leader of an Army was given the title *Imperator.* But that title could not be conferred upon him by the Senate of Rome nor by anyone else in power. No man could call himself *Imperator* until his own soldiers, the men under him, had publicly acclaimed him as such. If, voluntarily, his own men shouted '*Ave, Imperator!*' at a public gathering, then the man could claim the title. Later the title degenerated—" He stopped.

The manager was staring at him with uncomprehending eyes, and Morgan's outward smile became genuine. "Sorry," he said condescendingly. "I forgot that history is not a popular subject in the Welfare World." Morgan had forgotten no such thing, but he went right on. "What I meant to say was that the spaceman of the Belt Cities have voluntarily agreed among themselves to call me 'sir'. Whether that is a title of ability or a title of courtesy, you can argue about with me at another time. Right now, I want my room key."

Under the regulations, the manager knew there was nothing else he could do. He had made a mistake, and he knew that he had. If he had only taken the trouble to read the rest of the card—

"Awfully sorry, Mr. Morgan," he said with a lopsided smile that didn't even look genuine. "The—"

"Watch those courtesy titles," Morgan reprimanded gently. " 'Mister' comes ultimately from the Latin *magister,* meaning 'master' or 'teacher'. And while I may be your master, I wouldn't dare think I could teach you anything."

"All citizens are entitled to be called 'Mister'," the manager said with a puzzled look. He pushed a room key across the desk.

"Which just goes to show you," said Harry Morgan, picking up the key.

He turned casually, took one or two steps away from the registration desk, then—quite suddenly—did an about-face and snapped: *"What happened to Jack Latrobe?"*

"Who?" said the manager, his face gaping stupidly.

Harry Morgan knew human beings, and he was fairly certain that the manager couldn't have reacted that way unless he honestly had no notion of what Morgan was talking about.

He smiled sweetly. "Never you mind, dear boy. Thank you for the key." He turned again and headed for the elevator bank, confident that the manager would find the question he had asked about Jack Latrobe so completely meaningless as to be incapable of registering as a useful memory.

He was perfectly right.

III

The Belt Cities could survive without the help of Earth, and the Supreme Congress of the United Nations of

Earth knew it. But they also knew that "survive" did not by any means have the same semantic or factual content as "live comfortably". If Earth were to vanish overnight, the people of the Belt would live, but they would be seriously handicapped. On the other hand, the people of Earth could survive—as they had for millennia—without the Belt Cities, and while doing without Belt imports might be painful, it would by no means be deadly.

But both the Belt Cities and the Earth knew that the destruction of one would mean the collapse of the other as a civilization.

Earth needed iron. Belt iron was cheap. The big iron deposits of Earth were worked out, and the metal had been widely scattered. The removal of the asteroids as a cheap source would mean that iron would become prohibitively expensive. Without cheap iron, Earth's civilization would have to undergo a painfully drastic change—a collapse and regeneration.

But the Belt Cities were handicapped by the fact that they had had as yet neither the time nor the resources to manufacture anything but absolute necessities. Cloth, for example, was imported from Earth. A society that is still busy struggling for the bare necessities—such as manufacturing its own air—has no time to build the huge looms necessary to weave cloth . . . or to make clothes, except on a minor scale. Food? You can have hydroponic gardens on an asteroid, but raising beef cattle, even on Ceres, was difficult. Eventually, perhaps, but not yet.

The Belt Cities were populated by pioneers who still had not given up the luxuries of civilization. Their one weakness was that they had their cake and were happily eating it, too.

Not that Harry Morgan didn't realize that fact. A Belt man is, above all, a realist, in that he must, of necessity, understand the Laws of the Universe and deal with them. Or die.

Commodore Sir Harry Morgan was well aware of the stir he had created in the lobby of the Grand Central Hotel. Word would leak out, and he knew it. The scene had been created for just that purpose.

"Grasshopper sittin' on a railroad track,
Singin' polly-wolly-doodle-alla-day!
A-pickin' his teeth with a carpet tack,
Singin' polly-wolly-doodle-alla-day!"

He sang with gusto as the elevator lifted him up to the seventy-fourth floor of the Grand Central Hotel. The other passengers in the car did not look at him directly; they cast sidelong glances.

This guy, they seemed to think in unison, *is a nut. We will pay no attention to him, since he probably does not really exist. Even if he does, we will pay no attention in the hope that he will go away.*

On the seventy-fourth floor, he *did* go away, heading for his room. He keyed open the door and strolled over to the phone, where a message had already been dropped into the receiver slot. He picked it up and read it.

COMMODORE SIR HARRY MORGAN, RM. 7426, GCH: REQUEST YOU CALL EDWAY TARNHORST, REPRESENTATIVE OF THE PEOPLE OF GREATER LOS ANGELES, SUPREME CONGRESS. PUNCH 33-981-762-044 COLLECT.

"How news travels," Harry Morgan thought to himself. He tapped out the number on the keyboard of the phone and waited for the panel to light up. When it did, it showed a man in his middle fifties with a lean, ascetic face and graying hair, which gave him a look of saintly wisdom.

"Mr. Tarnhorst?" Morgan asked pleasantly.

"Yes. Commodore Morgan?" The voice was smooth and precise.

"At your service, Mr. Tarnhorst. You asked me to call."

"Yes. What is the purpose of your visit to Earth, commodore?" The question was quick, decisive, and firm.

Harry Morgan kept his affability. "That's none of your business, Mr. Tarnhorst."

Tarnhorst's face didn't change. "Perhaps your superiors haven't told you, but—and I can only disclose this on a sealed circuit—I am in sympathy with the Belt Cities. I have been out there twice and have learned to appreciate the vigor and worth of the Belt people. I am on your side, commodore, in so far as it does not compromise my position. My record shows that I have fought for the rights of the Belt Cities on the floor of the Supreme Congress. Have you been informed of that fact?"

"I have," said Harry Morgan. "And that is precisely why it is none of your business. The less you know, Mr. Tarnhorst, the safer you will be. I am not here as a representative of any of the City governments. I am not here as a representative of any of the Belt Corporations. I am completely on my own, without official backing. You have shown yourself to be sympathetic towards us in the past. We have no desire to hurt you. Therefore I advise that you either keep your nose out of my business or actively work against me. You cannot protect yourself otherwise."

Edway Tarnhorst was an Earthman, but he was not stupid. He had managed to put himself in a position of power in the Welfare World, and he knew how to handle that power. It took him exactly two seconds to make his decision.

"You misunderstand me, commodore," he said coldly. "I asked what I asked because I desire information. The People's Government is trying to solve the murder of Commodore Jack Latrobe. Assuming, of course, that it *was* murder—which is open to doubt. His body was found three days ago in Fort Tryon Park, up on the north end of Manhattan Island. He had apparently jumped off one of the old stone bridges up there and fell ninety feet to his death. On the other hand, it is possible that, not being used to the effects of a field of point nine eight Standard gees, he did not realize that the fall would be deadly, and accidentally killed himself. He was alone in the park at night, as far as we can tell. It has been ascertained definitely that no representative of the People's Manufacturing Corporation Number 873 was with him at the time. Nor, so far as we can discover, was anyone else. I asked you to call because I wanted to know if you had any information for us. There was no other reason."

"I haven't seen Jack since he left Juno," Morgan said evenly. "I don't know why he came to Earth, and I know nothing else."

"Then I see no further need for conversation," Tarnhorst said. "Thank you for your assistance, Commodore Morgan. If Earth's Government needs you again, you will be notified if you gain any further information, you may call this number. Thank you again. Good-by."

The screen went blank.

How much of this is a trap? Morgan thought.

There was no way of knowing at this point. Morgan knew that Jack Latrobe had neither committed suicide nor died accidentally, and Tarnhorst had told him as much. Tarnhorst was still friendly, but he had taken the hint and got himself out of danger. There had been one very important piece of information. The denial that any representative of PMC 873 had been involved. PMC 873 was a manufacturer of biological products—one of the several corporations that Latrobe had been empowered to discuss business with when he had been sent to Earth by the Belt Corporations Council. Tarnhorst would not have mentioned them negatively unless he intended to imply a positive hint. Obviously. Almost too obviously.

Well?

Harry Morgan punched for Information, got it, got a number, and punched that.

"People's Manufacturing Corporation Ey-yut Seven Tha-ree," said a recorded voice. "Your desire, pu-leeze?"

"This is Commodore Jack Latrobe," Morgan said gently. "I'm getting tired of this place, and if you don't let me out I will blow the whole place to Kingdom Come. Good bye-eye-eye."

He hung up without waiting for an answer.

Then he looked around the hotel suite he had rented. It was an expensive one—very expensive. It consisted of an outer room—a "sitting room" as it might have been called two centuries before—and a bedroom. Plus a bathroom.

Harry Morgan, a piratical smile on his face, opened the bathroom door and left it that way. Then he went into the bedroom. His luggage had already been delivered by the lift tube, and was sitting on the floor. He put both suitcases on the bed, where they would be in plain sight from the sitting room. Then he made certain preparations for invaders.

He left the door between the sitting room and the bedroom open and left the suite.

Fifteen minutes later, he was walking down 42nd Street toward Sixth Avenue. On his left was the ancient Public Library Building. In the middle of the block, somebody shoved something hard into his left kidney and said, "Keep walking, commodore. But do what you're told."

Harry Morgan obeyed, with an utterly happy smile on his lips.

IV

In the Grand Central Hotel, a man moved down the hallway toward Suite 7426. He stopped at the door and inserted the key he held in his hand, twisting it as it entered the keyhole. The electronic locks chuckled, and the door swung open.

The man closed it behind him.

He was not a big man, but neither was he undersized. He was five-ten and weighed perhaps a hundred and sixty-five pounds. His face was dark of skin and had a hard, determined expression on it. He looked as though he had spent the last thirty of his thirty-five years of life stealing from his family and cheating his friends.

He looked around the sitting room. Nothing. He tossed the key in his hand and then shoved it into his pocket. He walked over to the nearest couch and prodded at it. He took an instrument out of his inside jacket pocket and looked at it.

"Nothin'," he said to himself. "Nothin'." His detector showed that there were no electronic devices hidden in the room—at least, none that he did not already know about.

He prowled around the sitting room for several minutes, looking at everything—chairs, desk, windows, floor—everything. He found nothing. He had not expected to, since the occupant, a Belt man named Harry Morgan, had only been in the suite a few minutes.

Then he walked over to the door that separated the sitting room from the bedroom. Through it, he could see the suitcases sitting temptingly on the bed.

Again he took his detector out of his pocket. After a full minute, he was satisfied that there was no sign of any complex gadgetry that could warn the occupant that anyone had entered the room. Certainly there was nothing deadly around.

Then a half-grin came over the man's cunning face. There was always the chance that the occupant of the suite had rigged up a really old-fashioned trap.

He looked carefully at the hinges of the door. Nothing. There were no tiny bits of paper that would fall if he pushed the door open any further, no little threads that would be broken.

It hadn't really seemed likely, after all. The door was open wide enough for a man to walk through without moving it.

Still grinning, the man reached out toward the door.

He was quite astonished when his hand didn't reach the door itself.

There was a sharp feeling of pain when his hand fell to the floor, severed at the wrist.

The man stared at his twitching hand on the floor. He blinked stupidly while his wrist gushed blood. Then, almost automatically, he stepped forward to pick up his hand.

As he shuffled forward, he felt a *snick! snick!* of pain in his ankles while all sensation from his feet went dead.

It was not until he began toppling forward that he realized that his feet were still sitting calmly on the floor in their shoes and that he was no longer connected to them.

It was too late. He was already falling.

He felt a stinging sensation in his throat and then nothing more as the drop in blood pressure rendered him unconscious.

His hand lay where it had fallen. His feet remained standing. His body fell to the floor with a resounding *thud!* His head bounced once and then rolled under the bed.

When his heart quit pumping, the blood quit spurting.

A tiny device on the doorjamb, down near the floor, went *zzzt!* and then there was silence.

V

When Representative Edway Tarnhorst cut off the call that had come from Harry Morgan, he turned around and faced the other man in the room. "Satisfactory?" he said.

"Yes. Yes, of course," said the other. He was a tall, hearty-looking man with a reddish face and a friendly smile. "You said just the right thing, Edway. Just the right thing. You're pretty smart, you know that? You got what it takes." He chuckled. "They'll never figure anything out now." He waved a hand toward a chair. "Sit down, Edway. Want a drink?"

Tarnhorst sat down and folded his hands. He looked down at them as if he were really interested in the flat, unfaceted diamond, engraved with the Tarnhorst arms, that gleamed on the ring on his finger.

"A little glass of whisky wouldn't hurt much, Sam," he said, looking up from his hands. He smiled. "As you say, there isn't much to worry about now. If Morgan goes to the police, they'll give him the same information."

Sam Fergus handed Tarnhorst a drink. "Damn right. Who's to know?" He chuckled again and sat down. "That was pretty good. Yes sir, pretty good. Just because he thought that when you voted for the Belt Cities you were on their side, he believed what you said. Hell, *I've* voted on their side when it was the right thing to do. Haven't I now, Ed? Haven't I?"

"Sure you have," said Tarnhorst with an easy smile. "So have a lot of us."

"Sure we have," Fergus repeated. His grin was huge. Then it changed to a frown. "I don't figure them sometimes. Those Belt people are crazy. Why wouldn't they give us the process for making that cable of theirs? Why?" He looked up at Tarnhorst with a genuinely puzzled look on his face. "I mean, you'd think they thought that the laws of nature were private property or something. They don't have the right outlook. A man finds out something like that, he ought to give it to the human race, hadn't he, Edway? How come those Belt people want to keep something like that secret?"

Edway Tarnhorst massaged the bridge of his nose with a thumb and forefinger, his eyes closed. "I don't know. Sam. I really don't know. Selfish, is all I can say."

Selfish? he thought. *Is it really selfish? Where is the dividing line? How much is a man entitled to keep secret, for his own benefit, and how much should he tell for the public?*

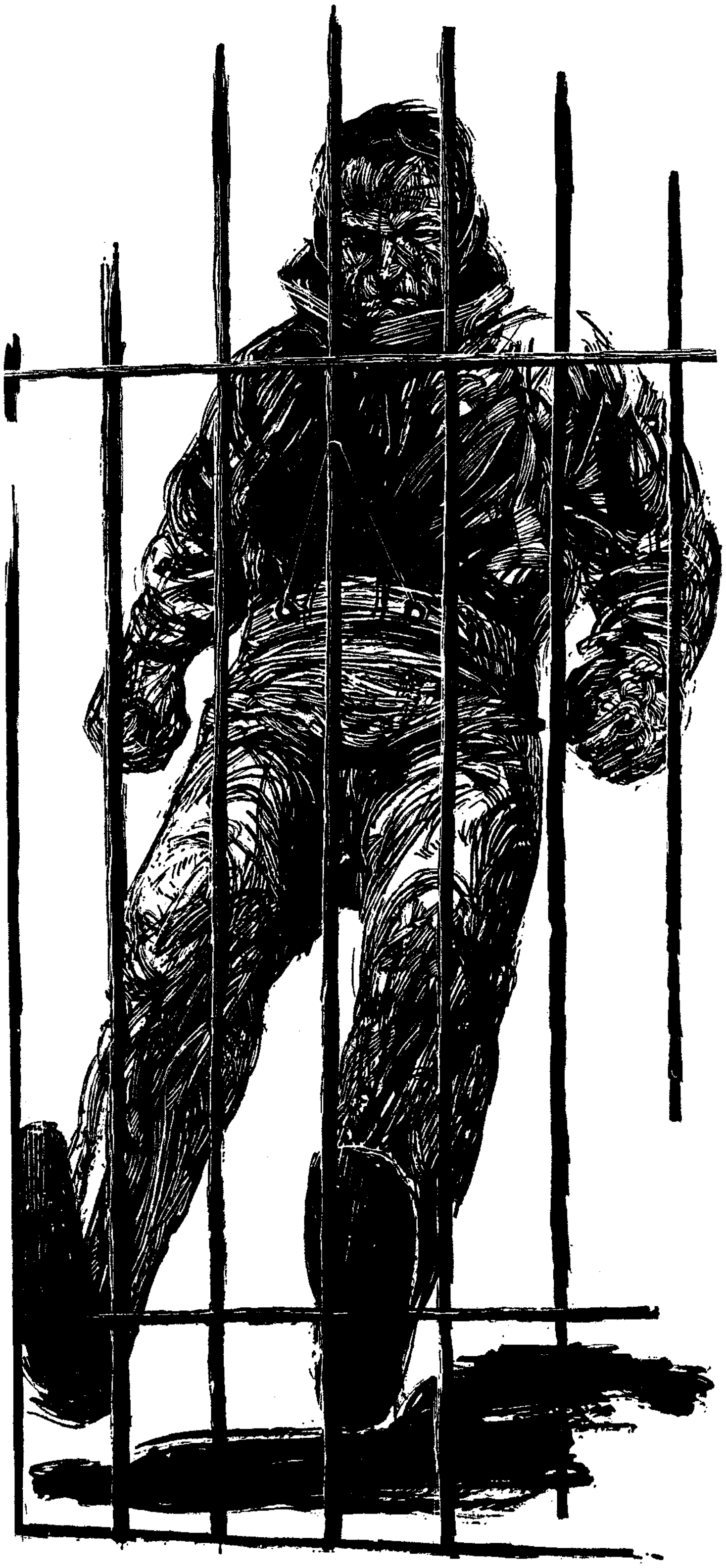
He glanced again at the coat of arms carved into the surface of the diamond. A thousand years ago, his ancestors had carved themselves a tiny empire out of middle Europe—a few hundred acres, no more. Enough to keep one family in luxury while the serfs had a bare existence. They had conquered by the sword and ruled by the sword. They had taken all and given nothing.

But had they? The Barons of Tarnhorst had not really lived much better than their serfs had lived. More clothes and more food, perhaps, and a few baubles—diamonds and fine silks and warm furs. But no Baron Tarnhorst had ever allowed his serfs to starve, for that would not be economically sound. And each Baron had been the dispenser of Justice; he had been Law in his land. Without him, there would have been anarchy among the ignorant peasants, since they were certainly not fit to govern themselves a thousand years ago.

Were they any better fit today? Tarnhorst wondered. For a full millennium, men had been trying, by mass education and by mass information, to bring the peasants up to the level of the nobles. Had that plan succeeded? Or had the intelligent ones simply been forced to conform to the actions of the masses? Had the nobles made peasants of themselves instead?

Edway Tarnhorst didn't honestly know. All he knew was that he saw a new spark of human life, a spark of intelligence, a spark of ability, out in the Belt. He didn't dare tell anyone—he hardly dared admit it to himself—but he thought those people were better somehow than the common clods of Earth. Those people didn't think that just because a man could slop color all over an otherwise innocent sheet of canvas, making outré and garish patterns, that that made him an artist. They didn't think that just because a man could write nonsense and use erratic typography, that that made him a poet. They had other beliefs, too, that Edway Tarnhorst saw only dimly, but he saw them well enough to know that they were better beliefs than the obviously stupid belief that every human being had as much right to respect and dignity as every other, that a man had a *right* to be respected, that he *deserved* it. Out there, they thought that a man had a right only to what he earned.

But Edway Tarnhorst was as much a product of his own society as Sam Fergus. He could only behave as he had been taught. Only on occasion—on very special occasion—could his native intelligence override the "common sense" that he had been taught. Only when an emergency arose. But when one did, Edway Tarnhorst, in spite of his



environmental upbringing, was equal to the occasion.

Actually, his own mind was never really clear on the subject. He did the best he could with the confusion he had to work with.

"Now we've got to be careful, Sam," he said. "Very careful. We don't want a war with the Belt Cities."

Sam Fergus snorted. "They wouldn't dare. We got 'em outnumbered a thousand to one."

"Not if they drop a rock on us," Tarnhorst said quietly.

"They wouldn't dare," Fergus repeated.

But both of them could see what would happen to any city on Earth if one of the Belt ships decided to shift the orbit of a good-sized asteroid so that it would strike Earth. A few hundred thousand tons of rock coming in at ten miles per second would be far more devastating than an expensive H-bomb.

"They wouldn't dare," Fergus said again.

"Nevertheless," Tarnhorst said, "in dealings of this kind we are walking very close to the thin edge. We have to watch ourselves."

VI

Commodore Sir Harry Morgan was herded into a prison cell, given a shove across the smallish room, and allowed to hear the door slam behind him. By the time he regained his balance and turned to face the barred door again, it was locked. The bully-boys who had shoved him in turned away and walked down the corridor. Harry sat down on the floor and relaxed, leaning against the stone wall. There was no furniture of any kind in the cell, not even sanitary plumbing.

"What do I do for a drink of water?" he asked aloud of no one in particular.

"You wait till they bring you your drink," said a whispery voice a few feet from his head. Morgan realized that someone in the cell next to his was talking. "You get a quart a day—a halfa pint four times a day. Save your voice. Your throat gets awful dry if you talk much."

"Yeah, it would," Morgan agreed in the same whisper. "What about sanitation?"

"That's *your* worry," said the voice. "Fella comes by every Wednesday and Saturday with a honey bucket. You clean out your own cell."

"I *thought* this place smelled of something other than attar of roses," Morgan observed. "My nose tells me this is Thursday."

There was a hoarse, humorless chuckle from the man in the next cell. " 'At's right. The smell of the disinfectant is strongest now. Saturday mornin' it'll be different. You catch on fast, buddy."

"Oh, I'm a whiz," Morgan agreed. "But I thought the Welfare World took care of its poor, misled criminals better than this."

Again the chuckle. "You shoulda robbed a bank or killed somebody. Then theyda given you a nice rehabilitation sentence. Regular prison. Room of your own.

Something real nice. Like a hotel. But this's different."

"Yeah," Morgan agreed. This was a political prison. This was the place where they put you when they didn't care what happened to you after the door was locked because there would be no going out.

Morgan knew where he was. It was a big, fortresslike building on top of one of the highest hills at the northern end of Manhattan Island—an old building that had once been a museum and was built like a medieval castle.

"What happens if you die in here?" he asked conversationally.

"Every Wednesday and Saturday," the voice repeated.

"Um," said Harry Morgan.

" 'Cept once in a while," the voice whispered. "Like a couple days ago. When was it? Yeah. Monday that'd be. Guy they had in here for a week or so. Don't remember how long. Lose tracka time here. Yeah. Sure lose tracka time here."

There was a long pause, and Morgan, controlling the tenseness in his voice, said: "What about the guy Monday?"

"Oh. Him. Yeah, well, they took him out Monday."

Morgan waited again, got nothing further, and asked: "Dead?"

" 'Course he was dead. They was tryin' to get somethin' out of him. Somethin' about a cable. He jumped one of the guards, and they blackjacked him. Hit 'im too hard, I guess. Guard sure got hell for that, too. Me, I'm lucky. They don't ask me no questions."

"What are you in for?" Morgan asked.

"Don't know. They never told me. I don't ask for fear they'll remember. They might start askin' questions."

Morgan considered. This could be a plant, but he didn't think so. The voice was too authentic, and there would be no purpose in his information. That meant that Jack Latrobe really was dead. They had killed him. An ice cold hardness surged along his nerves.

The door at the far end of the corridor clanged, and a brace of heavy footsteps clomped along the floor. Two men came abreast of the steel-barred door and stopped.

One of them, a well-dressed, husky-looking man in his middle forties, said: "O.K., Morgan. How did you do it?"

"I put on blue lipstick and kissed my elbows—both of 'em. Going widdershins, of course."

"What are you talking about?"

"What are *you* talking about?"

"The guy in your hotel suite. You killed him. You cut off both feet, one hand, and his head. How'd you do it?"

Morgan looked at the man. "Police?"

"Nunna your business. Answer the question."

"I use a cobweb I happened to have with me. Who was he?"

The cop's face was whitish. "You chop a guy up like that and then don't know who he is?"

"I can guess. I can guess that he was an agent for PMC 873 who was trespassing illegally. But I didn't kill him. I was in . . . er . . . custody when it happened."

"Not gonna talk, huh?" the cop said in a hard voice. "O.K., you've had your chance. We'll be back."

"I don't think I'll wait," said Morgan.

"You'll wait. We got you on a murder charge now. You'll wait. Wise guy." He turned and walked away. The other man followed like a trained hound.

After the door clanged, the man in the next cell whispered: "Well, you're for it. They're gonna ask you questions."

Morgan said one obscene word and stood up. It was time to leave.

He had been searched thoroughly. They had left him only his clothes, nothing else. They had checked to make sure that there were no microminiaturized circuits on him. He was clean.

So they thought.

Carefully, he caught a thread in the lapel of his jacket and pulled it free. Except for a certain springiness, it looked like an ordinary silon thread. He looped it around one of the bars of his cell, high up. The ends he fastened to a couple of little decorative hooks in his belt—hooks covered with a shell of synthetic ruby.

Then he leaned back, putting his weight on the thread.

Slowly, like a knife moving through cold peanut butter, the thread sank into the steel bar, cutting through its one-inch thickness with increasing difficulty until it was halfway through. Then it seemed to slip the rest of the way through.

He repeated the procedure thrice more, making two cuts in each of two bars. Then he carefully removed the sections he had cut out. He put one of them on the floor of his cell and carried the other in his hand—three feet of one-inch steel makes a nice weapon if it becomes necessary.

Then he stepped through the hole he had made.

The man in the next cell widened his eyes as Harry Morgan walked by. But Morgan could tell that he saw nothing. He had only heard. His eyes had been removed long before. It was the condition of the man that convinced Morgan with utter finality that he had told the truth.

VII

Mr. Edway Tarnhorst felt fear, but no real surprise when the shadow in the window of his suite in the Grand Central Hotel materialized into a human being. But he couldn't help asking one question.

"How did you get there?" His voice was husky. "We're eighty floors above the street."

"Try climbing asteroids for a while," said Commodore Sir Harry Morgan. "You'll get used to it. That's why I knew Jack hadn't died 'accidentally'—he was murdered."

"You . . . you're not carrying a gun," Tarnhorst said.

"Do I need one?"

Tarnhorst swallowed. "Yes. Fergus will be back in a moment."

"Who's Fergus?"

"He's the man who controls PMC 873."

Harry Morgan shoved his hand into his jacket pocket "Then I have a gun. You saw it, didn't you?"

"Yes. Yes. . . . I saw it when you came in."

"Good. Call him."

When Sam Fergus came in, he looked as though he had had about three or four too many slugs of whisky. There was an odd fear on his face.

"Whatsamatter, Edway? I—" The fear increased when he saw Morgan. "Whadda you here for?"

"I'm here to make a speech, Fergus. Sit down." When Fergus still stood, Morgan repeated what he had said with only a trace more emphasis. "Sit down."

Fergus sat. So did Tarnhorst.

"Both of you pay special attention," Morgan said, a piratical gleam in his eyes. "You killed a friend of mine. My best friend. But I'm not going to kill either of you. Yet. Just listen and listen carefully."

Even Tarnhorst looked frightened. "Don't move, Sam. He's got a gun. I saw it when he came in."

"What . . . what do you want?" Fergus asked.

"I want to give you the information you want. The information that you killed Jack for." There was cold hatred in his voice. "I am going to tell you something that you have thought you wanted, but which you really will wish you had never heard. I'm going to tell you about that cable."

Neither Fergus nor Tarnhorst said a word.

"You want a cable. You've heard that we use a cable that has a tensile strength of better than a hundred million pounds per square inch, and you want to know how it's made. You tried to get the secret out of Jack because he was sent here as a commercial dealer. And he wouldn't talk, so one of your goons blackjacked him too hard and then you had to drop him off a bridge to make it look like an accident.

"Then you got your hands on me. You were going to wring it out of me. Well, there is no necessity of that." His grin became wolfish. "I'll give you everything." He paused. "If you want it."

Fergus found his voice. "I want it. I'll pay a million—"

"You'll pay nothing," Morgan said flatly. "You'll listen."

Fergus nodded wordlessly.

"The composition is simple. Basically, it is a two-phase material—like fiberglass. It consists of a strong, hard material imbedded in a matrix of softer material. The difference is that, in this case, the stronger fibers are borazon—boron nitride formed under tremendous pressure—while the softer matrix is composed of tungsten carbide. If the fibers are only a thousandth or two thousandths of an inch in diameter—the thickness of a human hair or less—then the cable from which they are made has tremendous strength and flexibility.

"Do you want the details of the process now?" His teeth were showing in his wolfish grin.

Fergus swallowed. "Yes, of course. But . . . but why do you—"

"Why do I give it to you? Because it will kill you. You have seen what the stuff will do. A strand a thousandth of an inch thick, encased in silon for lubrication purposes, got me out of that filthy hole you call a prison. You've heard about that?"

Fergus blinked. "You cut yourself out of there with the cable you're talking about?"

"Not with the cable. With a thin fiber. With one of the hairlike fibers that makes up the cable. Did you ever cut cheese with a wire? In effect, that wire is a knife—a knife that consists only of an edge.

"Or, another experiment you may have heard of. Take a block of ice. Connect a couple of ten-pound weights together with a few feet of piano wire and loop it across the ice block so that the weights hang free on either side, with the wire over the top of the block. The wire will cut right through the ice in a short time. The trouble is that the ice block remains whole—because the ice melts under the pressure of the wire and then flows around it and freezes again on the other side. But if you lubricate the wire with ordinary glycerine, it prevents the re-freezing, and the ice block will be cut in two."

Tarnhorst nodded. "I remember. In school. They—" He let his voice trail off.

"Yeah Exactly. It's a common experiment in basic science. Borazon fiber works the same way. Because it is so fine and has such tremendous tensile strength, it is possible to apply a pressure of hundreds of millions of pounds per square inch over a very small area. Under pressures like that, steel cuts easily. With a silon covering to lubricate the cut, there's nothing to it. As you have heard from the guards in your little hell-hole."

"Hell-hole?" Tarnhorst's eyes narrowed and he flicked a quick glance at Fergus. Morgan realized that Tarnhorst had known nothing of the extent of Fergus' machinations.

"That lovely little political prison up in Fort Tryon Park that the World Welfare State, with its usual solicitousness for the common man, keeps for its favorite guests," Morgan said. His wolfish smile returned. "I'd've cut the whole thing down if I'd had had the time. Not the stone—just the steel. In order to apply that kind of pressure, you have to have the filament fastened to something considerably harder than the stuff you're trying to cut, you see. Don't try it with your fingers or you'll lose fingers."

Fergus' eyes widened again and he looked both ill and frightened. "The man we sent . . . uh . . . who was found in your room. You—" He stopped and seemed to have trouble swallowing.

"Me? *I* didn't do anything." Morgan did a good imitation of a shark trying to look innocent. "I'll admit that I looped a very fine filament of the stuff across the doorway a few times, so that if anyone tried to enter my room illegally I would be warned." He didn't bother to add that a pressure-sensitive device had released and reeled in the filament after it had done its work. "It doesn't need to be nearly as tough and heavy to cut through soft stuff like . . . er . . . say, a beefsteak, as it does to cut through steel. It's as fine as cobweb almost invisible. Won't the World Welfare State have fun when that stuff gets into the hands of its happy, crime-free populace?"

Edway Tranhorst became suddenly alert. "What?"

"Yes. Think of the fun they'll have, all those lovely slobs who get their basic subsistence and their dignity and their honor as a free gift from the State. The kids, especially. They'll *love* it. It's so fine it can be hidden inside an ordinary thread—or woven into the hair—or . . ." He spread his hands. "A million places."

Fergus was gaping. Tarnhorst was concentrating on Morgan's words.

"And there's no possible way to leave fingerprints on anything that fine," Morgan continued. "You just hook it around a couple of nails or screws, across an open doorway or an alleyway—and wait."

"We wouldn't let it get into the people's hands," Tarnhorst said.

"You couldn't stop it," Morgan said flatly. "Manufacture the stuff and eventually one of the workers in the plant will figure out a way to steal some of it."

"Guards—" Fergus said faintly.

"*Pfui.* But even if you had a perfect guard system, I think I can guarantee that some of it would get into the hands of the—common people. Unless you want to cut off all imports from the Belt."

Tarnhorst's voice hardened. "You mean you'd deliberately—"

"I mean exactly what I said," Morgan cut in sharply. "Make of it what you want."

"I suppose you have that kind of trouble out in the Belt?" Tarnshorst asked.

"No. We don't have your kind of people out in the Belt, Mr. Tarnhorst. We have men who kill, yes. But we don't have the kind of juvenile and grown-up delinquents who will kill senselessly, just for kicks. That kind is too stupid to live long out there. We are in no danger from borazon-tungsten filaments. You are." He paused just for a moment, then said: "I'm ready to give you the details of the process now, Mr. Fergus."

"I don't think I—" Fergus began with a sickly sound in his voice. But Tarnhorst interrupted him.

"We don't want it, commodore. Forget it."

"Forget it?" Morgan's voice was as cutting as the filament he had been discussing. "Forget that Jack Latrobe was murdered?"

"We will pay indemnities, of course," Tarnhorst said, feeling that it was futile.

"*Fergus* will pay indemnities," Morgan said. "In money, the indemnities will come to the precise amount he was willing to pay for the cable secret. I suggest that your Government confiscate that amount from him and send it to us. That may be necessary in view of the second indemnity."

"Second indemnity?"

"Mr. Fergus' life."

Tarnhorst shook his head briskly. "No. We can't execute Fergus. Impossible."

"Of course not," Morgan said soothingly. "I don't suggest that you should. But I do suggest that Mr. Fergus be very careful about going through doorways—or any other kind of opening—from now on. I suggest that he refrain from passing between *any* pair of reasonably solid, well-anchored objects. I suggest that he stay away from bathtubs. I suggest that he be very careful about putting his legs under a table or desk. I suggest that he not look out of windows. I could make several suggestions. And he shouldn't go around feeling in front of him, either. He might lose something."

"I understand," said Edway Tarnhorst.

So did Sam Fergus. Morgan could tell by his face.

* * *

When the indemnity check arrived on Ceres some time later, a short, terse note came with it.

"I regret to inform you that Mr. Samuel Fergus, evidently in a state of extreme nervous and psychic tension, took his own life by means of a gunshot wound in the head on the 21st of this month. The enclosed check will pay your indemnity in full. Tarnhorst."

Morgan smiled grimly. It was as he had expected. He had certainly never had any intention of going to all the trouble of killing Sam Fergus. ■

> "We hear much today about the problem of reprocessing waste to produce food aboard some manned space vehicle. We think of this as a grim but necessary step under unique conditions. We forget that the human race has always lived on a space vehicle circling the Sun and has always lived by reprocessing waste. If we think of Earth as a space ship, we may keep house better and handle our garbage more carefully."

JOHN D. ISAACS,
Scripps Institution of Oceanography,
CAPACITY OF THE OCEANS.
International Science and Technology,
Prototype Issue, p. 38
(Conover-Mast Publications,
205 E. 42nd St., New York 17, N.Y.)
"Entire contents fully restricted."

CRACKING THE CODE

continued from page 16

from human red blood pigment, hemoglobin, be carried by an electric current through filter paper before treating them with partitioning solutions. One specific mutation put the amino acid valine in the place of glutamic acid, changing the normal hemoglobin molecule into hemoglobin S.

In human beings mutations occur at a rate of about once in seventy thousand, meaning that a normal gene can survive that great number of human generations before it changes. Though mutations of well-known human genes are rare, people are not. Human populations have been intensely studied in order to assess the rate of mutations under standard conditions on the home planet. We have many, if not sufficient, basic data for predictions of what may happen to space colonizers exposed to increased risks of mutations.

Returning to this aspect later on we shall first investigate the possible clue to the DNA code offered by mutations. We have a wealth of information of the end results of such heritable changes in man. We have also experimental data sustaining the contention that alterations in plain text words correspond to definite changes in the code triplets. A gene mutation may consist in the replacement of a single code triplet. Then we could, theoretically, make an inventory of observed mutations of the type CUBE for TUBE. The triplet that was substituted should read T and the new triplet should read C. The objections against this approach are of a pure practical nature.

Let us accept known amino acid sequences as our plain text. We can avoid making too much of the fact that we do not actually know the number of steps between the coded information of the DNA molecule and the highly active substances, such as hormones, enzymes and oxygen transporters, made up of the amino acids. We cannot, however, slur over the dearth of data on replacement of single amino acids by mutations. We have not plain text enough for this approach.

Still worse, we cannot intercept the DNA messages. Such obstacles would seem arduous enough to nullify the heuristic value of this hypothetical approach. But, if we return to the simple arithmetic of subtracting the number of amino acids constituting the plain text alphabet of life from the number of possible code triplets, we get $64 - 20 = 44$. Considering the degeneracy of the code this excess of triplets may imply, we emphasized the safety factor. In military and diplomatic codes degeneracy is used to ward off decoding, words with a high frequency in the plain text are coded in several different ways and nonsense words are included in the cryptogram. Now we can take up to meaningful discussion the safety factor from the point of view of protection against mutations.

Dramatic results of mutations such as blindness and congenital deafness are well-known. They correspond to replacement of critical code triplets. A distortion of this nature would make an intended PEACE read PEACH. Slight misspellings almost certainly occur as results of mutations, of the type DEMUDULAT*e*R. Both types of effects seem to have their biologic counterparts in mutations affecting and sparing the active centers of enzymes.

A third type of mutation escapes attention when we observe the clinical effects; it deserves consideration as a mishap that becomes innocuous only because of the degeneracy of the code. This type of mutation would change the triplet TGT, meaning A, to TAT, likewise standing for a plain text A.

In sum, scanty knowledge and deductive reasoning admitted predictions about the code. When experimental evidence was still lacking a non-overlapping, four-letter code with base triplets corresponding to plain text letters, or amino acids, looked like an acceptable working hypothesis.

Then chemists and microbiologists devised new tools for producing chains of amino acids under the control of artificial RNA. It is worth remembering now that the secret signals are in DNA code, they are relayed through RNA, which helps the plain text letters of the amino acid chains to find their proper places. DNA is deoxyribonucleic acid, RNA is ribonucleic acid; while the former has the letters AGTC, the latter codes with AGUS, thymine being replaced by uracil. Otherwise RNA closely resembles DNA.

A sort of artificial DNA has been used to reveal the mode of translating sequences in AGTC code into the corresponding AGUC code sequences. Thus polymers of the DNA chain structure but with only T T T T T . . . in constant repetition, helped by a specific catalyst, produce an A A A A A . . . polymer with RNA structure. By this procedure it has been found that the primary information is carried over to the relaying RNA by resort to a simple substitution cipher:

DNA: A G T C
RNA: U C A G

Laws of chemical necessity rather than a yen for secrecy determine this letter substitution when RNA is formed. This is how recent studies of the relayed messages in UCAG code can be used for apparently exact interpretations of the DNA signals. This work has just begun, its initial results open a new era in biology and medicine.

By feeding artificial RNA to cell-free saps from crushed bacteria Nirenberg in Bethesda, Maryland, and Ochoa in New York could produce artificial polypeptides, or chains of amino acids. In both laboratories such artificial relay signals produced identical results. Now RNA code triplets have been established for each of the twenty amino acids that constitute the plain text letters in the alphabet prevailing throughout the realm of life.

There is little need for extolment of this feat of discovery; a future generation may full well look upon it as the rock bottom of the life sciences. It is much of an anticlimax to mention that Nobel awards keep raining upon the code crackers. Though only a few names have been mentioned here several distinguished groups of scientists have made possible this astonishing solution of an intricate communication problem.

They have also raised a most fascinating fence of question marks. If silent observers from high-brow galaxies think of tests of their own invention before they decide to woo us, they can spare much effort by just observing how such remaining problems as that of order within the code triplets are tackled. Many problems inherited from the pre-code era have gained in complication.

In 1956 Barthelmess, of the Botanical Institute in Munich, Germany, published a review titled "*Mutagene Arzneimittel*"—drugs producing mutations. He argued that all drugs should be routinely tested for mutagenic activity. The argument was well substantiated then; it has become increasingly clear now that chemical interference with the coded signals can occur. A list of substances that actually break chromosomes looks rather nightmarish. It scores not only medicinal drugs but many chemicals in everyday use.

The degeneracy of the code may offer some protection against harmful radiation and chemical influence, sometimes a change will make the new triplet mean just the same as the old one. As a matter of fact human beings resist, to a limited extent, the untoward actions of ionizing radiation and chemical mutagens. We are, inevitably, exposed to some 4.3 r (roentgen units) over a thirty-year period, a dose of the same order of magnitude as sustained by a one-way passenger to Venus in the Mariner II capsule.

Why inevitably? The crust of the Earth is nowhere free from radioactive materials, an additional radiation dose from cosmic rays becomes appreciable at high altitudes, thus the total background radiation increases, for a thirty-year period, to 5.5 r in some places in the United States. We can hardly avoid the additional exposure connected with civilized living and fall-out from nuclear tests, adding up to almost the same amount. The average United States resident is exposed to about 8 r in thirty years.

What harm can such doses of radiation do? They change DNA code words; the misspelled words are faithfully reproduced from cell generation to cell generation, and inherited by new generations of individuals. We expect some mutations to do no or little harm, the misspelling may be innocuous. But we know a lot about harmful mutations, many of them appear as inherited abnormalities, notably of the skeletal system.

The latter include congenital dwarfism with short limbs and contracted pelvis. Here the mode of inheritance is dominant, a dwarf's children with a normal wife or husband are dwarfed and normal in equal proportions. The pelvic deformity associated with this chondrodystrophic dwarfism usually necessitates delivery by Caesarean section, and the number of children in families with the mother a dwarf is lower than average. Thus the mutated gene, or distorted signal, tends to be eliminated by the low fertility of women carriers.

But these dwarfs are not rarer now than in earlier generations. It can be concluded that their number is upheld by new mutations at a rate that can be calculated from the decreased fertility of chondrodystrophic dwarfs. As a matter of fact dwarfs are born to normal parents at a low but constant rate that fits such calculations.

A substantial part of organic nervous disease, mental illness and mental retardation, of blindness and deafness both congenital and with retarded onset, comes from mutations in one of the parents or forebears of the diseased persons. Thousands of human genes have been detected through the manifestations of mutations, most of which cause detrimental effects early or late in life. Though some mutations produce mere nuisances or relatively harmless taints, none of them is unconditionally favorable.

When conclusive experimental evidence for the mutagenic activity of radiation is added to the accumulated observations from human populations we get a clear-cut affirmation: Radiation is harmful to man, in small and moderate doses foremost by giving rise to mutations with more or less detrimental effects in future generations.

Venturing into space we would like to know more precisely what the risks amount to. Numerical values for the radiation dose that doubles human mutations have been given at the lower limit of 5 r and the higher of 150 r. Though extrapolations from studies of laboratory animals have aroused much controversy, the probable range may be within the limits of 30 r and 80 r.

Bluntly stated, it would take any additional amount of radiation from thirty to eighty roentgen units to increase the expected number of visible genetic defects in children from two millions to an ultimate four millions in the United States. Then defects with a late appearance or a less clear-cut inheritance are excluded.

Rocket dips through the Van Allen belts may inflict rather mild punishment upon the descendants of space pioneers, speed may be a sufficient protection. The shadow of the looming question mark increases, however, when economically powered space transport will carry migrants and colonizers widely within the home galaxy. Protective measures against cosmic radiation and radiation from sun flares will cost any multiple of $100 per pound passenger weight if we calculate with armor.

Before trying to improve the odds against genetic survival in space we shall see what happens to space migrants under extremely untoward conditions. Then we can reconsider the problem of protection against interference with the chemical code language.

An exodus into space as a solution, or avoidance, of problems on Earth would constitute the worst possible departure for space migration. Protection against radiation would probably be insufficient; if calculable, the chances of survival would be small under such offhand conditions. Our problem is not concerned with the fatalities, but it has to do with the possibility that survivors of early colonization projects may be few. Old-age pensioners enjoying their dignified leisure in the serene setting of Ganymede will need protection for their personal health against cosmic and sun flare radiation. More directly concerned with the problem at hand is whether children and people in the reproductive ages get a sufficient protection or not. Radiation doses that cause only minor injury to the individual may greatly increase the mutation rate with deleterious effects visible in future generations.

Then descendants of the first asteroid and planet colonizers will make up a rueful breed of misfits? We have to calculate with the whole series of gene mutations, changed code words. Survivors of radiation hazards that kill, say ninety per cent of the space travelers and first generation colonists, will suffer major chromosomal changes in addition to gene mutations. Some gross alterations will make for severe abnormalities, they can also combine whole code words into new and meaningful sentences.

A neat adjustment to internal and external environment has formed code sentences that cannot be changed with impunity. Through thousands of humanoid and human generations the "right" words have been selected and built into commands urging our species to survive. Any change will mean a deterioration, slight, serious, or fatal, under the fundamentally unchanged conditions on Earth. A nuclear holocaust here and a precipitate flight into space will cause much the same results.

Children of severely irradiated mothers will die at or before birth. Men and women will be sterile or of low fecundity. Small flocks of survivors will be forced to first-cousin matings, perhaps to incestuous unions, on Earth after the holocaust as well as in space, because of the scarcity of available mates. The offspring in such families will exhibit a rather complete array of skeletal, neuromuscular, enzymatic and perceptual disturbances. Scorched flocks on Earth and asteroids may have their survival chances limited to a few generations.

In a completely new surrounding rearranged code sentences may, however, spell an unexpected advantage. The exceptional, and in flocks of few families improbable, feat of accident that produces a helpful mutation, may appear in a Pallas colony or among Martian voortrekkers. And even a detrimental change that has some advantage in the form of an enhanced fertility will rapidly establish itself in a suitable location.

Studies by E. B. Ford in Oxford, England, have much to do with such changed code sentences in galactic migrants. These studies are also sobering in a time when tremendous investments of gadgets, money and supervisors are required to wring her secrets from Nature. By counting black and pale moths in manufacturing districts Ford revealed what amounts to a law of nature: Selective forces acting for and against an inherited trait maintain, within a given environment, the rate of occurrence of this trait at a relatively high level.

Several instances of strictly local superiority of otherwise detrimental genes have now been observed in human populations. Thus Central and Western African populations reveal a high frequency of a definite altered code triplet producing an abnormal hemoglobin. Carriers of this gene in duplicate produce an abnormal red blood pigment and die from a severe blood disease before reproductive age. Carriers of the *normal* gene in duplicate are killed, to a great extent, by the malignant local form of malaria. Carriers of the "bad" gene in single dose have an advantage because of their relative resistance to this form of malaria. Thus an excess of children in each generation are born to carriers of the distorted code word. The latter cannot become established as the norm for the simple reason that one fourth of the children of the superior gene carriers are killed by the severe blood disease.

Similar advantages may be found for otherwise untoward mutations when entirely new surroundings have to be coped with. People who are not in the least remarkable on Earth, if not for some tendency to laziness in the morning, may develop quite new faculties on a barren asteroid.

We may even stand before the possible birth of a new human species, Homo asteroides. Selective processes act rapidly when an advantage is great. Not only the external surroundings are different in space, new mutations will meet internal environments deviating from tellurian norms.

The first space migrants will be driven by an immense urge; it may be a profoundly human instinct of endeavor or a more primeval drift of panic. It cannot be excluded that the primary motive of space migration will man the vehicles with people with much the same mentality. And mental traits depend upon the genetic code words. More likely, the adventurers will have only their nonconformism in common. Then the code sentences will diverge, too.

One thing seems almost sure, the necessary smallness of the early colonies eliminates some code words by a random process. Thus it would be quite possible for the first Pallas colony to have lost blood group B. By mere chance scores of code words that are common in Homo sapiens will be absent in Homo asteroides. Old code words as well as mutations appear in a context that is not entirely new but definitely slanted. *Resistance* means one thing to an electrician and something else to a freedom fighter.

We need not calculate with the worst possible conditions for space travel and galactic colonization. We can hope to improve, here and soon, the eerie situation provoked by aimless interference with the code signals. Then space travelers will embark under more favorable basal circumstances.

Now we use food additives, permit insecticides to contaminate food and preserve meat with nitrates. These are

CRACKING THE CODE

Conclusion

all interferers with code signals under laboratory conditions. Acetaldehyde, produced when alcohol is burned in the human body, has been suspected as a signal distorter. Caffeine is known to twist code words under experimental conditions; it can reach the reproductive cells. Contrary to popular belief tea contains substantial amounts of caffeine. It is possible, but very far from certain, that caffeine is responsible for as many "spontaneous" mutations as the ordinary background radiation, both in coffee- and tea-drinking populations.

What quantity of distorted chemical signals are we propagating to our children? Part of the answer will be delivered when future generations bring together the distorted code signals in double sets, through matings between carriers of identically changed code triplets. Before blaming chemical technology for unintended interference with the code signals we may give modern chemistry its proper credit for breaking the code of biologic inheritance. Chemical industry readily produces whatever means that can be used for mass protection against mutagens and it will give us chemical interceptors against cancer-provoking signals.

Right now harmful effects of signal distortion can be mitigated; every successfully treated diabetic demonstrates this fact. In a near future we shall be able to read the genetic code language, transmissions in the RNA code are also within probable reach. Then the haphazard interference of today will be superseded by an ordered chemical conversation.

This means that harmful effects of radiation in space-travel and galactic colonization may be mitigated or even prevented by chemical protection. The costs of one single Moon shot would probably answer all essential remaining questions about the feasibility of the chemical conversation with the internal rulers of life. ■

EDITORIAL

(Continued from page 7)

four important amino-acid-bases; adenine, cystine, guanine and uracil. It is combinations of these four, taken three-at-a-time that make up the "words," or *codons.*

The codons are genetic-language "words" which specify a particular amino acid which is to be incorporated in a protein molecule being constructed—an enzyme, hormone, or tissue component.

Careful research established that, in the genetic language of the colon bacillus, certain identified codons "meant" certain specific and identified amino acids. I.e., the biochemists had succeeded in translating some of the codons of the colon bacillus genetic language into human language.

A scientist of Polaris B IIc studying human chemistry might learn to translate the symbols HCl into his native symbols * ~ > ; so human biochemists learned to translate *b. coli* genetic language into human language.

Our article "Cracking the Code," by Carl A. Larson, in this issue covers a good bit of the work done in that area. It's one of the neatest pieces of cross-collaboration between scientists in history; biologists, chemists, information-theory specialists, and computermen had to work as a team to get the answers.

Recently, scientists in that field have been able to make another important experimental step. If a specific codon, ACG, in *b. coli* geneticese "means" alanine—what does the codon ACG mean in the genetic language of other organisms? Or do all organisms "speak" the same genetic language?

The experiments performed recently by Dr. I. Bernard Weinstein, of the Columbia University College of Physicians and Surgeons, strongly indicate that *all terrestrial organisms "speak" the same genetic language.*

The identification of meaning of colon bacillus codons permitted checking those specific codons in the genetic DNA of other organisms, and determining whether these other organisms used the same "dictionary" of codons. Six specific codons were checked for "meaning" in the genetic language of a protozoon, *Chalmydomonas,* rat liver cells, and mouse tumor cells. All six codons, in each type of cell, correlated with the same specific amino acids.

The language for all these widely different organisms was the same, at least with respect to these six specific amino acids.

The evolutionary gap between *bacillus coli,* which belongs in the plant kingdom, and at an extremely primitive level, the protozoon, and the highly evolved rodent tissue cells is enormous. The branch-off of the plant and animal kingdoms must have occurred at least two billion years ago; the evolutionary level of the placental mammals represents perhaps a billion years of advance and development beyond the protozoon.

Any system of message encodement, that remains unchanged through some two thousand million years of transmission—through perhaps two *trillion* relayings from one generation to the next—has a most remarkable degree of stability. The encoding system carries genetic information; the genetic information is, of course, subject to mutation. It's those mutations over the megayears, that separated the bacillus, the protozoon and the rodents. But the *system of encoding* is evidently either absolutely immune to mutation, or so nearly so that not even two billion years of time, and two trillion relayings has altered it.

It's been suggested that the organisms all have the same genetic code because they all descended from the same original life-cell, and have not changed the coding since.

There's another possibility, however.

Nearly ten years ago, on a visit up to Cambridge, Massachusetts, I got together with a group of Harvard and MIT researchers—all science-fiction readers—in a fine bull-session discussion.

With "malice aforethought," I

threw in for discussion the following problem: Suppose that for some reason it is necessary to deposit a message on a planet—we'll make it a planet like the Earth—which is to be recoverable after a period of two billion years.

Now carving it in a mountainside won't work for that period of time. Nor will engraving it on platinum-iridium plates, even if we deposit hundreds of engraved plates all over the surface of the planet.

We'll make the message something relatively simple and specific, so we can discuss it—we'll say it's a statement concerning the interaction of carbon dioxide and water.

The discussion took off in fine fashion—and it was really being analyzed by some *highly* competent minds. As I recall, Claude Shannon, the founder of Information Theory, was there, and Warren Seaman, of the Harvard Computer Labs, Wayne Batteau, Instrumentation Theory specialist, and some of the men working on the machine translation of language at the Harvard Computer Labs.

It was strictly a discussion of a problem for the fun of analyzing problems; it lasted well over an hour and a half before they'd agreed on a general technique that could preserve such a message, on such a planet, over such a period of time.

To begin with, trying to establish some monument that can be stable against all tectonic, chemical and erosive attacks for any such period of time is nonsense; give up. A method of multiple-record must be used; the message must be inscribed so many times that even if a million copies are lost, there will be plenty more to be recovered.

But the use of multiple record introduces problems of error-multiplication. Moreover, no number of copies distributed across the planet's surface at any given time can be expected to be *sure* to leave some available at the surface a billion years later. Erosion and tectonic forces keep changing the surface.

It must, then, be not only a multiple-record system, but must also be self-replicating, and be given a tendency to seek the surface of the planet.

However, a self-replicating system now compounds the problem of error-transmission, since a defective copy of the message will tend to replicate the error indefinitely.

Somehow, the self-replicating message-carrier device must have an error-detecting-and-rejecting arrangement that will automatically destroy any false copies.

The entire discussion couldn't be printed here, even if I had a magnetic tape recording of it. (Which, I deeply regret, I do not!) The essence of it was that, starting from the proposed problem, these Information Theory and Instrumentation Theory men derived precisely the fundamental mechanism of genetics. And the discussion had gone on for well over an hour before they consciously recognized that they were, in fact, defining genetics!

Dr. Weinstein should have been there! The genetic mechanism is, clearly, precisely such a mechanism as that group sought to define; it has preserved, in *very* multiple record, a precisely accurate message concerning the interaction of carbon dioxide and water—try living on this planet without that information!—and preserved it without error for better than two billion years.

The message is self-replicating, and has a built-in mechanism for eliminating faulty copies. (Any cell with false notions about the interaction of CO_2 and H_2O is immediately self-terminating!)

That the message is recoverable, even after this immense span of time, is being proven by the work of Dr. Weinstein and his associates in the genetic decoding work.

That the message has been preserved accurately—i.e., correctly—is demonstrated by the fact that the living cells are living successfully.

The one factor that wasn't brought out in that bull-session discussion was that it is advantageous to have self-replicating multiple-record devices of many variant types, so that ideally the self-replicating message-carriers should be capable of self-generated adaptations as the planetary surface varies over the megayears. There's no need to make the devices unable to carry additional messages; the requirement was only that The Message should be carried on infallibly.

I think the reason why all terrestrial life has the same basic genetic language—uses the same codon-dictionary—is, simply, because That's The Way This Universe Is. Hydrogen is not cultural; it's universal. The laws of chemistry aren't the private opinions of human beings—or of terrestrial life. There is one, and only one way of making a hydrogen atom. The interactions of CO_2 and H_2O are what they are, and there is no alternative. You *can't* have any different opinions . . . and stay alive in this Universe.

I'm willing to bet that, when we get a chance to study extraterrestrial life, we'll find that the codon-dictionary is not merely a terrestrial-life dictionary—but the dictionary of biochemistry for all *CHONS*, we might say. CHONS standing for Carbon, Hydrogen, Oxygen, Nitrogen, Sulfur life forms.

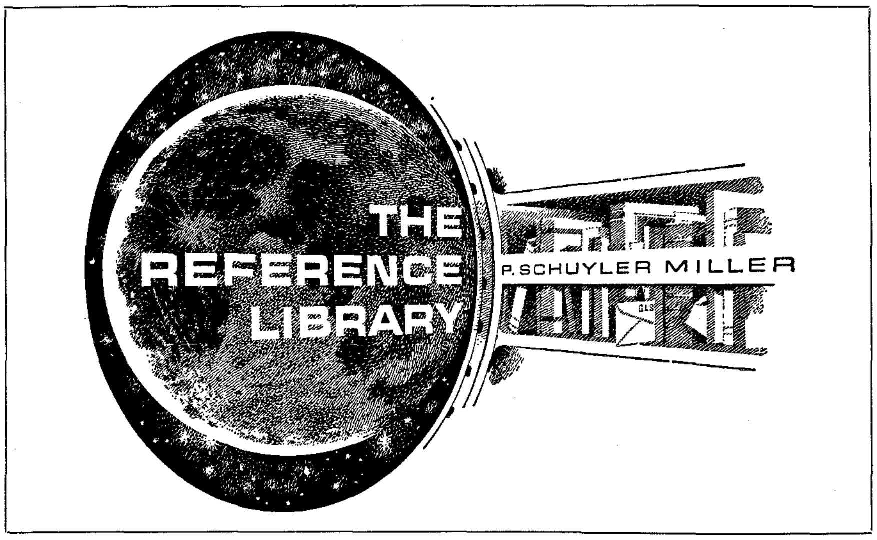
Life's business seems to be preserving The Message of Life across gigayears of time, unfailingly, accurately, and always recoverably. The face of a planet isn't stable; it changes beyond recognition in even a few megayears. No structure of matter is stable against the changes of billions of years; even the nuclei of stable atoms are not certainly trustworthy over such a span. Ask any carbon-14 dating expert!

Only the absolute, fundamental laws of the Real Universe are to be considered adequately stable for The Message . . . with the added proviso that if those laws are not, in fact, stable, the self-replicating multiple-copy message eventually transmitted and recovered will then not be accurate, *but will be true!* For the message will have changed to preserve the *meaning*, rather than the *fact!*

Hydrogen isn't cultural, as H. Beam Piper pointed out.

And I'll bet that the genetic codons aren't terrestrial, either.

THE EDITOR



PBI

As most regular attendees at scientific conventions—or science-fiction conventions—know well, the best part of the convention takes place apart from the scheduled meetings. In hotel rooms, or "down in the bar," or in the park across the street all kinds of off-the-record ideas are bandied about in friendly, free-wheeling interchange. Nothing comes of most of them; others take off in a wholly exciting way. It is this free exchange of "partly-baked ideas"—pbi—that is so disastrously blocked by security restrictions which, allegedly, are still in force to the point where some scientists cannot read their own reports after they have been filed.

A truly remarkable collection of such partly-baked ideas has been collected and put into print by a group of English scientists under the title, "The Scientist Speculates"—Basic Books, New York; 413 pages; $6.95. The book's preface, complete, reads: "The intention of this anthology is to raise more questions than it answers." This hope is fully realized.

Some of the ideas proposed in the one hundred twenty-three contributions are facetious, some are trivial, some are meaty, and many dig deeper into physics and mathematics than I can follow without a good deal of study. The proposal of John T. Phillifent that sheer, full-fashioned nylon is as suitable for the upper parts of the feminine form as for the lower represents one extreme—though the suggestion may be of practical value to the publishers of *Rogue* or *Playboy*. At the opposite extreme are such contributions as David Bohm's "Proposed Topological Formulation of the Quantum Theory." Most of the contributors are British, and the editor and publisher have not found it necessary to identify them for the general reader; however, Isaac Asimov is represented with his proposal of the "light-mile" as a unit of time, Harlow Shapley suggests that there may be small, self-heated planetlike stars in great numbers scattered through space, and Gertrude Schmeidler urges other scientists to "fit in" a little psi with their experiments. Arthur Clarke is there, too, with a neat little block of five questions.

The sections of the book are: "Ideas About Ideas" (eight contributions); "Information About Information" (twelve); "Minds, Meaning and Cybernetics" (twenty—mainly quite serious); "PSI" (twenty also); "Sociology, Economics, Operational Research and Games" (fifteen); "Biology" (twenty-two); "Physics" (twelve); "Mathematics, Logic, Probability and Statistics" (eight); and "Technical Ideas" (seven). Dr. I. J. Good, editor and liberal contributor, is himself a mathematician and statistician with ideas on just about everything.

If you like "hard" science fiction—the technical kind—this is a book for you. If you write it, you've probably already reaped a rich harvest from it.

One partly-baked idea which is being pushed in full seriousness by its originator is described in a seventy-nine-page mimeographed treatise entitled "The Prospect of Immortality." It is available, at an unspecified "cost," from the author, R. C. W. Ettinger, at 24041 Stratford (Street? Avenue? Drive?—it seems a status gimmick not to say, these days), Oak Park 37, Michigan. If you saw the condensation in *Galaxy* you know Mr. Ettinger's thesis—that we should put our dead into a Deep Freeze at the temperature of liquid helium, until such a time as medicine is ready and able to thaw them out, bring them to life, replace their faulty apparatus with transplanted, synthetic or mechanical organs, and enable everybody to live forever. The author obviously does *not* consider his ideas "partly-baked"—he has convinced himself, and wants to convince the world, that it is high time we get going.

Mr. Ettinger is a former faculty member of Wayne State University, Detroit, and as of last year was a Science Faculty Fellow there under a National Science Foundation grant. His basic premise, that decay can be indefinitely postponed at temperatures near absolute zero, is probably sound enough, but I can't accept or follow his economic or sociological arguments, which have been worked out more thoroughly and intelligently in numerous science-fiction stories. There are also discursions after some of the author's pet causes, including bomb shelters and waitresses.

Another rare collection of partly-baked ideas will be found in "The Proceedings: Chicon III" published by Advent: Publishers at P.O. Box 9228, Chicago 90, Illinois. Members of the Chicon—*last* year's annual World Science-Fiction Convention—have received copies; a few more *may* be available at $3.50. I assure you—it's enough to make a man stay up days and sit in on the program!

LOST CITIES AND VANISHED CIVILIZATIONS

by Robert Silverberg
Chilton Co., Philadelphia
1962 • 177 pp • $3.95

SUNKEN HISTORY

by Robert Silverberg
Chilton Co., Philadelphia
1963 • 177 pp • $3.95

The first of these two books for young people was an award winner in the New York *Herald Tribune's* annual Spring Book Festival contest. "Sunken History" is considerably better in that the ground covered is less familiar and, it seems to me, the material is less adapted to a supposed juvenile level of interest and understanding.

Both books are part of the avalanche of archeological popularizations touched off by "Gods, Graves and Scholars." I have commented on a few of the best here, and spared you mention of many more. On the positive side, publishers have been persuaded that books on archeology may gain them prestige or money, or even both, and have commissioned or bought books at which few of them would have looked in the past. On the negative, the same ground has been trampled over and over, all too often by writers who are rewriting each other, with no real understanding of their subject or of the wealth of fascinating material that has been ignored or missed.

I don't know whether Bob Silverberg has any special interest in archeology or not; certainly, nobody would ever accuse him of doing sloppy work. In "Lost Cities" he describes rather sketchily the archeological work which has taught us what we know about Pompeii, Troy, Knossos, Babylon, Chichen Itza and Angkor. Since I am more interested in what is found in the excavation of such places than in the lives of the men who did the work—or had it done—I may be excessively unimpressed by another set of capsule portraits of Schliemann, Layard and the rest. To a youngster who has never read anything of the kind, "Lost Cities and Vanish Civilizations" should be a good introduction and spur to further reading. But teen-agers—the ones who are not loafing on street corners or organizing a rumble or drag-racing in front of my house—have probably been reading the adult books, if they have any prior interest.

"Sunken History" is something else again—perhaps just a reflection of my own ignorance, but I think not. The scientists who are doing this work are not imposing names from the past. They did not live and work in an era when archeology was—as too much "classical" archeology still is—organized treasure hunting. They not only use but invent tools and techniques: Cousteau's Aqualung, Link's air lift, and a good deal more. Bob Silverberg brings this current adventure and science to life just as effectively as he does the adventure in one of his SF yarns, from the Nineteenth Century discoveries of Greek sponge divers at the bottom of the Mediterranean down to the raising of the Swedish warship *Vasa* after three hundred thirty-five years at the bottom of Stockholm harbor. He has also supplied a thoughtful, fruitful set of notes for further reading—even to Atlantis and Ys.

Just to make my excitement over the book incomplete, and to exhibit suitable inconsistency, my main complaint about "Sunken History" is that he has missed some of the most interesting treasure stories—the work divers are doing on Spanish treasure ships in the Caribbean and off the Bahamas. This is full of fascinating bits of archeological anecdotage: olive jugs filled with gold coins minted in Peru, with pitch poured in so that the crew couldn't steal a handful from time to time . . . gold chain used for small change; you simply snipped off the requisite number of uniform links . . . the electrochemistry of what is preserved and what isn't, when different metals are in contact at the bottom of the sea.

If these two books are successful, perhaps Bob Silverberg will be invited to do another. There's a whale of a lot of the world left, and if he lets himself go as he has done in his second book, Number Three should be a humdinger and a multiple prize-winner.

ALIEN WORLD

by Adam Lukens
Avalon Books, New York
1963 • 192 pp • $2.95

Adam Lukens is maintaining his tradition of not repeating himself, but in other respects is not up to his own standards with this story about an unspecified planet called "Nightmare Hollow," which might otherwise be Jupiter.

He begins with a tangled personal situation. His hero, writer Mark Tatum, is holed up with his memories in a back-of-nowhere club, when his one-armed brother, Carl, finds him. Mark's estranged wife, their son, and an older son by a former marriage, have all gone off to Nightmare Hollow, and the two men go after them. In the beginning, the situation begins to develop interestingly. A native humanoid race, the "Toad People," have attractive females who accept the human colonists as mates, but repulsive males—and Jane seems attracted to one of these. She disappears into the desert, and everyone goes pelting afterward—and the book comes apart. The Toad People are just nice folks in an underground world, human to the extent of being able to interbreed with Earth folk. They have their queer customs—but so does everyone, doesn't he? The crises don't crise, and the climaxes don't climb.

Too bad—Adam Lukens is generally a lot better than this.

ENVOY TO NEW WORLDS
by Keith Laumer
FLIGHT FROM YESTERDAY
by Robert Moore Williams
Ace Books, New York
1963 • No. F-223 • 134 + 120 pp • 40¢

The longer and better half of this Ace "Double" is a series of six of the "Retief" stories that have been running in *If*. They are not pretentious, but good, lively fun on the plane of Poul Anderson's Dominick Flandry yarns. Jame Retief is a Third Secretary in the Terrestrial Corps Diplomatique when we meet him in "Protocol," and he has not risen very far by the end of "Palace Revolution," but he has succeeded in making himself a thoroughly indispensable member of the staff in any out-world Embassy—whether because of his ability to meet monsters on their own ground and understand their peculiar mores, or because of his knack of handling Terrans just as smoothly. Granted, on a high intellectual level, that the monsters are even more human than the humans—this is for fun, and there just might be a lesson for our own State Department in the Retief primer.

"Flight from Yesterday" reads like an action yarn from the old days of *Startling Stories* or *Thrilling Wonder*, though no credit is given to a previous source. It's a pretty fair piece of hugger-mugger in which people from Atlantis are implanting their personalities on physical doubles of today—presumably their remote descendants. All kinds of mystery and magic—a little green stone—a death ray—but better people than usual.

THE RUNNING MAN
by J. Hunter Holly
Monarch Books, Derby, Conn.
1963 • No. 342 • 142 pp • 35¢

Miss Holly's stories, for reasons best known to her and the SF editors, do not appear in the magazines; this is an original paperback, and her best since "Encounter." If her technique continues to improve, she'll be able to sell paperback mysteries as fast as she can write them, and that will be that . . .

The running man of the title collars our hero, college liberal Jeff Munro. He actually says very little of importance, but that little—plus the ruthless way in which the man is run down and destroyed—convinces Jeff that something very peculiar is going on behind the scenes of the Heralds for Peace, a fanatic organization that is gaining recruits everywhere. Since the cover tells you so, I'm revealing no secret to say that the Heralds are dominated by extraterrestrial intelligences, though not quite the ordinary kind. And for a never wholly plausible reason, Jeff is invited to join the inner circle—or else.

This might have been an opportunity for a confusing paradox of value like Jack Williamson's "Humanoids," but it sticks to the obvious levels. Even so, if Hollywood ever picks up one of Miss Holly's stories and produces it with reasonable fidelity, it just might make a good picture.

THE WORLDS OF SCIENCE FICTION
edited by Robert P. Mills
Dial Press, New York
1963 • 349 pp • $4.95

Here is one of the best science-fiction anthologies we have had—not a poor story in it, and most of them very good and very modern. Because they *are* so good, you'll know some of them, but the only real veteran of the lot is John Collier's "Evening Primrose." All that I had read are worth reading again.

The only real gimmick stories in the book are by people you would not expect to use this form: Robert A. Heinlain's "All You Zombies—", the time-paradox story that ends all time-paradox stories, Damon Knight's "Babel II," quite unabashed, and James Blish's "A Work of Art," which makes the gimmick totally unimportant. Poul Anderson has a wholly uncharacteristic piece in "Night Piece," about as far from his superb adventure yarns as you'd want to get, and Isaac Asimov has outdone himself in "The Ugly Little Boy," which is unlike anything else he has written. For a similar theme, similarly yet differently handled, read it with Avram Davidson's "Now Let Us Sleep."

A special note of interest is added by the fact that each story is its author's favorite, and that he has contributed a long or short note explaining why he likes it. (Alfred Bester's closing note explains why he doesn't like anything he has done and consequently couldn't contribute.)

As Bob Mills says in his introduction: "There is one constant—man" in all the stories. That's what makes them *modern* science fiction.

THE IMPOSSIBLES
by Mark Phillips
Pyramid Books, N. Y.
No. F-875 • 1963 • 157 pp • 40¢

This is the second of the misadventures of FBI Agent Kenneth Malone among the psionic crimes of 1972. His first was the memorable "Little Old Lady," which originated here and saw paperback publication last year as "Brain Twister". Another, "Occasion for Disaster," was published here in 1960-'61.

This time Malone is up against the impossibilities of red Cadillacs that drive off with nobody in them, and that slug cops and himself with lamentable efficiency. There are the associated puzzles of cash, liquor, jewelry and other goodies that vanish out of locked premises. As the plot thickens, it picks up a gang of kids who can walk through walls and out of police stations.

By this time, knowing Malone, you will realize that he is up against a gang of juvenile teleportation experts. And when you need to know how to hang onto a teleporting kid, you call Queen Elizabeth I, the psychopathic telepath of Yucca Flats. And thereafter things start moving faster than ever, and getting more confused than ever.

Key clue: unlike author Randall Garrett, who shares the name "Mark Phillips" with Laurence M. Janifer, the members of the Silent Spooks will never be found "down in the bar" at a science-fiction convention. For that matter, a Garrett who could teleport would break up a SF convention. Janifer I don't know, so he is immune from such comments. Pity—some of his unique personality must flavor these stories, if only I could detect it.

LEGEND OF LOST EARTH
by G. McDonald Wallis
ALPHA CENTAURI OR DIE!
by Leigh Brackett
Ace Books, New York
No. F-187 • 1963 • 133 + 121 pp • 40¢

Paperback publishers—at least, this publisher—no longer credit original copyrights, in an attempt to make their reprints look like originals. This is justified on the debatable ground that the paperback edition is either expanded or condensed from the magazine version, and hence merits a new copyright.

In this case, I believe both stories are reprints but haven't been able to track them down. In Leigh Brackett's case, she is far too busy scripting in Hollywood to write any new far-world adventure stuff, and in any case she writes better SF nowadays. In the case of Miss Wallis' yarn, it reads like one that would have been a featured novel in whatever magazine first published it, and I can't find it in the files at hand. What ever happened to that second volume of Day's "Index to the Science Fiction Magazines: 1951- "?

They are both good adventure stories—"Lost Earth" the better because "Centauri" isn't top Brackett. Earth is not only lost but forgotten by the Irish exiles of Niflhel, except for the disciples of a banned cult who believe that there was an Earth and that they can find their way back there. The Norse-Germanic "Niflhel" for a Celtic world, by the way, is a false note that jars on me when Miss Wallis has made such exceedingly good use of the ancient Irish and other Celtic lays and chants to lend mystic reality to her world and its people. For it is this rich setting that lends the story distinction. Its plot is nominally the old one about the underground of dedicated idealists, struggling against a corrupt and oppressive overlordship, and the young hero of the privileged classes who is drawn into the battle for the Cause. But, then, isn't that the tradition of Ireland against the English?

Leigh Brackett's story is very similar, but this time the spacemen are fighting for the cause of freedom of space, and the oppressors are the robots who have taken over everywhere and do their efficient best to keep the little human bugs out of the machinery of running civilization. How a handful of rebels recondition an ancient freighter, fight off the invulnerable robots, and make it to Alpha Centauri, and the disturbing and remarkable things they find there, make an exciting story. No classic, but fun and rich with ideas and twists. What more do you want for twenty cents?

SWORDS OF MARS
by Edgar Rice Burroughs
Ballantine Books, New York
No. F-728 • 1963 • 191 pp • 50¢

SYNTHETIC MEN OF MARS
by Edgar Rice Burroughs
Ballantine Books, New York
No. F-739 • 1963 • 160 pp • 50¢

Ballantine is now publishing the authorized paperback reprints of Burroughs' books, beginning with the Martian series, while Canaveral Press is handling the new hardback editions, including some stories—beginning to appear in November—never before in book form. Meanwhile, since Ace has the intervening books in print, Ballantine has jumped from No. 3 to No. 8 in the adventures of John Carter. No. 10, "Llana of Gathol," will terminate the reprints; Canaveral includes two novelettes in a book scheduled for next spring.

"Swords of Mars" is the low point in the Martian series, to my taste. John Carter, trying to break up the Assassins' Guild, goes in disguise to the hostile city of Zodanga and spends the rest of the book in characteristic escapes and swordplay. He is involved with two Zodangan mad scientists who have invented spaceships—one telepathically controlled—and when his wife, the beautiful Dejah Thoris, is kidnaped, they all head for the nearer Martian moon. Here some truly remarkable physics is invented to provide elbow room on the five-mile-through satellite: it seems that you shrink as you approach, so that you reach Thuria scaled down to the same relative size you would have on Barsoom—Mars. Burroughs does employ what is probably the only feasible means of producing invisibility: telepathically induced mass hynotism—a sort of "out of mind, out of sight" arrangement. He also tosses in a race of cat people and does very little with them. Either he or the editor who was serializing the story then seems to have grown tired of it, and loose ends are bundled into a few paragraphs and dropped in the trash.

"Synthetic Men" is a little livelier fare, though the intended horror is not very horrible. Ras Thavas, "Master Mind of Mars" from three books back, is sought to repair Dejah Thoris, who has been in a traffic accident. While she lingers at death's door, the old scientist is found on another island in the Toonolian Marshes, much like that where we first met him. This time he is trying to make men, and has succeeded only in generating monsters like those in the author's much older and cruder "Monster Men." There is a revolt of the synthetic men, the tissue vat runneth over, and things look grim before John Carter gets back to rescue his companion, who has nobly taken an "inside" job by having his brain transferred to a monster's skull. Why John Carter did not first try his fellow Earthling, Ulysses Paxton alias Vad Varo, deponent sayeth not: Ras Thavas keeps insisting that his former assistant is just as competent as he is. In fact, the two Jasoomians seem never to have met up to this point.

These later books, which date from 1934-'35 and 1938-'39 respectively, lack the free-wheeling imagination of the first three. They are not even of much help to the enthusiast who is mapping Burroughs' Mars.

WARLORD OF KOR
by Terry Carr
THE STAR WASPS
by Robert Moore Williams
Ace Books, New York
No. F-177 • 1963 • 97 + 126 pp • 40¢

"Warlord of Kor," the shorter of the two "novels" in this Ace Double, is also the more interesting. In it a human expeditionary corps on a distant world are trying to interrogate the remnants of the only intelligent race Man has ever found among the stars. The huge, sluggish reptilians have true racial memories, so that the entire past of their kind can be probed telepathically—except where psychological blocks have been erected to shut off certain areas.

The trouble is that Man knows very well that there is or has been another spacefaring race abroad in the Galaxy, older and probably more powerful and dangerous than humans. Artistic and archeological evidence show that the Hirlaji were once in contact with the Outsiders; question is, are the Outsiders still lurking in the wings, waiting to pounce? The expedition's leader sees no reason why the question can't be made moot by simply eliminating the handful of Hirlaji who remain. Archeologist Lee Rynason and his psychologist girl friend have other ideas—and so, it turns out, do the Hirlaji. They also have a god, Kor, who millennia before had told them to give up science and technology and lead their present vegetative life.

It's all worked out in a final burst of action.

"Star Wasps" gives us a Big Business society carried to the ultimate and dominating Earth. The hero is a rebel against this Establishment, and he has also trained himself to see the sparkling blue lights from the stars, invisible to most people, which drift around the planet killing people in an arbitrary and decidedly alarming manner. Then there are the green lights that seem to be able to kill the blue lights.

All this follows a pretty predictable path to a ditto conclusion. What isn't predictable is that Johnny Derek makes a very likable and convincing hero-type protagonist. He saves the story from being completely familiar.

THE ATOM CONSPIRACY
by Jeff Sutton
Avalon Books, New York
1963 • 192 pp. • $2.95

This is neither one of Avalon's outright lemons nor one of its unfortunately rarer prizes. It's just a conventional plot-and-counterplot story with espers, in which the principal—and guessable—puzzle is who is on which side, and how many sides are there anyway.

The particular gambit in use is the one in which atomic energy and research have been outlawed by the world society which follows "the" atomic war. This edict has stuck for four hundred fifty years, until 2449 A.D. The world is divided into castes based on intelligence, or something which has been given that label; the point ignored by many educators today, that a test score is not the same kind of measure as the width of this page, is made, but far too subtly to be of much use. The politicians of the World Council of Six can and do cram for the "intelligence" tests.

In the midst of the election hurly-burly the Prime Thinker reports evidence that undercover atomic research is going on somewhere on Earth, violating the First Law of Mankind. He appoints a low IQ agent, Max Krull, to find the criminals. But Krull is not a real LIQ—he is a telepath, who has deliberately concealed his ability rather like the "Children of the Atom" in Shiras' classic "In Hiding." Espers, though not illegal, are universally persecuted. They also involve themselves in the investigation through an old man who can see past, present and future.

Like a whole school of private-eye detective stories, Krull really does very little but wander around and wait for things to happen. He does have a role in the final showdown, when the plotters are unmasked, the role of the espers cleared up, and the future of Mankind pegged down. Indeed, in view of the prescience of the old esper, Herman Bok, it becomes apparent that the motive behind much of the fairly violent action is to assure that Krull *does* stand around until he is needed to carry the ball.

A lot more could have been done with this background.

FULL CIRCLE
by Bruce Ariss
Avalon Books, New York
1963 • 224 pp • $2.95

Here, from a new writer, is a promising story that keeps building up to a series of letdowns. Even so, it is better than a lot that Avalon has been putting between hard covers lately.

It seems that the usual Final War has left much of the world desolate. In North America, however, remnants of a few Indian tribes have survived, come out into the empty lands, and rebuilt a consciously ritualized replica of their pre-contact culture. There must be no machines, but the libraries left by the white men may be used by a chosen few. Then, on one of Tall Eagle's visits to the Cave of Knowledge, he discovers one of the legendary Toad Men—a survivor of Project TOAD, the selected survival group who have been cooped up in a cave under Mount Rushmore for ten generations.

John 10, the red-headed last white man, is about as nasty a type as you could wish to have swapping philosophies with a noble Red Man like Tall Eagle. He has been conditioned from birth to carry out one mission: get out, get his weapons out, and destroy the last Russian. The Indians' ideas and values mean nothing to him, and in the end his single-mindedness leads to his murder of Tall Eagle's father.

The idea of contrasting the values of the Indian way of life with those of an ultra-militarized mechanical society is a good one, but in practice it descends to an argument in which nobody is listening to anybody else. An embryo Ice Age descends on Tall Eagle's people, almost overnight, yet it is never rationalized and really never used except as a stage setting. The game animals leave, yet the Sioux—whose ancestors were among the most mobile of the Plains peoples—do not follow them. The Indians are made, for some mystical reason, a new Chosen People, since nowhere else in the world can John 10 find survivors of the War of Poisoned Lightnings.

"Full Circle" could have been a very good book. It is an interesting one.

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4. The owner is: The Condé Nast Publications Inc., Greenwich, Connecticut, 06830. Stockholder: The Patriot-News Co., Harrisburg, Pennsylvania.

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I certify that the statements made by me above are correct and complete.

(Signed) Robert E. Park, Business Manager

OUTPOST OF JUPITER

by Lester del Rey

Holt, Rinehart & Winston, New York

1963 • 191 pp • $2.95

The one-time Winston series of juvenile science-fiction books has thinned down now to about one a year. These are not books that could be dropped into a current magazine, as can some of those by Robert Heinlein and James Blish. They are written for younger and less sophisticated readers, but they are no more oversimplified in plots and concepts than were the typical adult science-fiction stories of the Thirties and early Forties.

Lester del Rey has turned out good books for the series with remarkable consistency. This is his sixth, and one of the others was a Junior Literary Guild selection while a second earned a Boys' Clubs of America award.

The hero, Bob Wilson, is marooned in the struggling human colony on Ganymede when his biochemist father has a heart attack. Soon they are involved with a double problem: a plague of unknown source and nature, and hostile beings who raid their much-needed supplies from Earth. Needless to say, a solution is reached by achieving friendly relations with the supposedly hostile creatures from Jupiter—but how this is brought about is described plausibly and realistically. This is good stuff for beginners—then let 'em have Heinlein.

A PLANET CALLED EARTH

by George Gamow

Viking Press, New York

1963 • 257 pp • $5.75

This is a complete rewriting of the author's previous book "Biography of the Earth." He reports that an attempt to revise the twenty-year old book, four years ago, brought down such an avalanche of critical vituperation from earth scientists that he settled down and produced an all-new work.

If you don't know Gamow—winner of UNESCO's 1956 Kalinga Prize as one of the world's most important popularizers of science—this book will give you a fair sample of his unique ability to see the facts and relationships of science from a fresh and significant point of view. Who else, for example, would have pointed out that a mouse is a far more effective energy-producer than the sun?

On the other hand, this is not Gamow at his best. The farther he strays from the frontiers of cosmology and astronomy and the paradoxes with which the atom is bursting, the less at home he seems with his material. Certainly, I should have expected him to make much of the fascinating phenomena connected with convection currents within the Earth's plastic mantle, and their synchronization with the size of the core as the trigger to set off a cycle of mountain-building. For a rather technical symposium on *that*, I refer you instead to "Continental Drift," edited by S. K. Runcorn of King's College, England, published by Academic Press in 1962 for $12.

Gamow, who is now Professor of Physics at the University of Colorado and an over-the-hill neighbor of Robert A. Heinlein's, is at work on "A Star Called the Sun"—a similar "rejuvenation," as he calls it, of his companion book, "The Life and Death of the Sun." There, up to his knees in nuclear reactions and cosmic physics, he should be much happier than he seems to be here on Earth.

AND THE REPRINTS

THREE TIMES INFINITY

edited by Leo Margulies

Gold Medal Books, Greenwich, Conn.

No. d-1324 • 1963 • 176 pp. • 50¢

A re-reprint of the three-part anthology: "Lorelei of the Red Mist," by Leigh Brackett and a very young Ray Bradbury; "The Golden Helix," by Theodore Sturgeon; and "Destination Moon," by Robert A. Heinlein. None of them are at their best.

THE REFERENCE LIBRARY

STAR WAYS
by Poul Anderson
Ace Books, N. Y.
1963 • No. D-568 • 143 pp • 35¢

Paperback of the 1958 Avalon novel about the Nomad world ships of the far future. "Enjoyable from first to last, fast-moving and convincing," I said then.

LLANA OF GATHOL
by Edgar Rice Burroughs
Ballantine Books, New York
1963 • No. F-762 • 191 pp • 50¢

Tenth and last of Burroughs' Mars books: capture and escape as always.

THE CLIPPER OF THE CLOUDS
by Jules Verne
Associated Booksellers, Westport, Conn.
1962 • 191 pp • $3.00

MASTER OF THE WORLD
by Jules Verne
Associated Booksellers, Westport, Conn.
1962 • 188 pp • $3.00

The two parts—written twenty years apart—of the exploits of "Robur the Conqueror," in the Fitzroy edition.

7TH ANNUAL EDITION:
THE YEAR'S BEST S-F
edited by Judith Merril
Dell Publishing Co., New York
No. 9773 • 1963 • 399 pp. • 75¢

All of these Merril anthologies are bargains. These are the 1961 selections.

THE LONG WINTER
by John Christopher
Crest Books, Greenwich, Conn.
No. d612 • 1963 • 208 pp. • 50¢

A paperback edition of the 1962 Simon & Schuster hardback, in which the white peoples have to throw themselves on the mercy of the Africans, as the northern lands are submerged in the ice.

MUTANT
by Henry Kuttner
Ballantine Books, New York
No. F-724 • 1963 • 191 pp. • 50¢

One of the best of the books that comments on the hazards of being different. It originally appeared here in Astounding as a series of stories, beginning in 1943. These have been woven together into the chronicle of the telepathic Baldies and their struggle for survival.

I, ROBOT
by Isaac Asimov
Doubleday & Co., Garden City, N.Y.
1963 • 218 pp. • $3.50

Doubleday has published a new hardbound edition of one of the science-fiction classics of recent times. I'm told they have also put out new editions of "Foundation" and "Foundation and Empire," but I haven't seen them.

THE LIGHTS IN THE SKY ARE STARS
by Fredric Brown
Bantam Books, New York
No. J2578 • 1963 • 149 pp. • 40¢

New printing of an intensely human story about the fight for space. Read it as an antidote to the "What's the use?" philosophy now gaining strength.

THE GREAT EXPLOSION
by Eric Frank Russell
Pyramid Books, New York
No. F-862 • 1963 • 160 pp. • 40¢

Reprint of last year's hardback, in which a survey ship encounters some of the fragments of the population explosion which took man to the stars and left him stranded there.

THE ANALYTICAL LABORATORY

SEPTEMBER, 1963

PLACE	STORY	AUTHOR	POINTS
1.	Industrial Revolution	*Winston P. Sanders*	1.37
2.	The Thirst Quenchers	*Rick Raphael*	2.58
3.	Chrono-Control	*Frank A. Javor*	3.37
4.	Am I Still There?	*James R. Hall*	3.65
5.	The Last Straw	*William J. Smith*	3.86

THE EDITOR

BRASS TACKS

(Continued from page 5)

Dear Mr. Campbell:

In your editorial for the August, 1963 issue you entered into some excellent comments and observations upon the idea of the Rational versus the Logical, showing that they can, at times, be quite different.

I would like to offer a concrete example of the aforesaid situation which is of prime importance in our present civilization.

Let us first observe that there is a one-to-one correspondence between Boolian Algebra and electrical circuitry. We could arrange a table of Boolian functions and associate each function uniquely with an electrical switching and/or relay system. The flow or not-flow of current is the strict analog of the true or not-true function of the Boolian Algebra. Switches in parallel have the "or" function, while switches in series have the "and" function. An open switch functions as the "not" function, a closed switch represents the positive function. Or a double-pole, single-throw snap switch can be used to represent the direct and converse modes of a proposition, et cetera.

Thus, the characteristics of any circuit can be expressed symbolically by means of Boolian Algebra, and conversely, any statement in Boolian Algebra can be realized as an electrical circuit. If legal manipulations will simplify the Boolian statement to another form, the new form will produce an equivalent new circuit that will do all that the original did, but probably more simply.

There are two basic functions in Boolian Algebra that are always true no matter what actual data may be substituted for the variables:

1. The Law of Tautology: a is either b, or not b.
2. The Law of the Excluded Middle: a is not both b, and not-b.

In an Aristotelian system, such as required by Boolian Algebra, a must go all the way in belonging to b, or not belonging to b. Even in graduated systems, a belongs to some degree to b or not at all. And there is no way that a can straddle the fence between b and not-b. Each of the two laws above is the converse of the other, and each implies the other.

If any set of statements can be reduced by the use of Boolian Algebra or even verbally to the second Law, we say that we have arrived at a paradox, or an absurdity. Thus if we take the statement "This sentence is a falsehood," we will wind up confronted with the necessity of classifying the sentence as being at once true and not true. Or at least meaningless, and in any event useless. In fact most present-day systems of logic attempt to forestall statements that will lead to such an absurdity.

It is, therefore, a good thing that symbolic logic, and particularly Boolian Algebra was not known to the earlier electrical inventors, because a strict adherence to its principles and precepts would have ruled out any possibility of a doorbell or buzzer, to say nothing of a Ford spark-coil; such an invention would have been impossible!

For the buzzer—which activates the spark coil—is the exact electrical analog model of a logical absurdity: when it is "on" it activates the electromagnet that shuts it off, and once it is off the spring returns it to the "on" position again. (Shutting it off, of course, shuts off the magnet, too, which is why it returns to "on".) So away goes the buzzer in hysterical indecision. If its output is connected to the primary of a transformer, the secondary will deliver an output of alternating current. This is the first prototype of a converter.

But according to the laws of logic such a phenomenon is an absurdity and *cannot exist.*

A similar situation was prevalent at one time long ago in mathematics. Pure functions of the square root of minus one were disallowed, and in token thereof such numbers were called "imaginary," which unfortunate misnomer is still with us today. It is a good thing that these earlier algebraists did not discover Differential Equations, because the solution of a differential equation of the second degree with a zero coefficient at the first-order derivative results in a *pure imaginary* solution—which expresses sustained oscillation, and is the basis for radio transmission.

Sustained oscillation is one of the prime keystones of modern civilization, and is, therefore, highly rational, *but not logical!*

It is a more than usually striking analogy that exists between the orthogonality of the square root of minus one with the "real" axis, and the relation of the so-called "absurdity" to acceptable logical functions. Such an idea might well be the basis for a better form of a symbolic logic. I would very much like to see what Dr. Gunther's system would make out of the foregoing.

It may be that logic is primarily for technicians, whereas the working tool of the creative genius should be intuition only. And intuition, as you pointed out, is chiefly a function of the subconscious.

John P. Fairfax
1620 Howard Avenue,
Burlingame, California.

Those are really nice points! So every doorbell and buzzer is a logical impossibility!

Dear John:

Your editorial in Analog for September is real gone if I may use a beatnik term. Now I know why I never managed to get rich. I would like to drive a brass tack if I may regarding Mr. Richardson's Polaris in the same issue. If the man knows an astronomer who can take a pix all the way around I would like to suggest a procedure that would make the positions of the stars a great deal clearer to knuckleheads like me. Every time I see an article on astronomy the pictures are always taken from the poles or are such fractional coverages that the ordinary citizen is usually unable to place the picture in the sky.

Why can't some erudite gent with a

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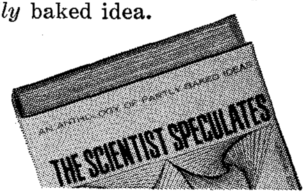

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BRASS TACKS

Kodak set up on the equator and take a series of shots that could be assembled into a strip showing all of the visible stars all the way around? The finished strip could be pasted around a drum and then the average knot-head could get a better idea of where the darn things are. Of course the finished product should be plated on a ball with the earth at the center but the triangular strips for that sort of thing are hardly the thing for anyone but an astronomer to put together.

Someone ought to make a ball with a light inside and the stars on the outside that people could buy just as they can buy a globe of the earth. The victim could punch the stars with a needle and have a planetarium in the kitchen. Does anyone sell such a thing in a small size? Say about fifteen inches in diameter? If the names of the stars were printed on the outside you could cover the one that you want to locate with your finger and the corresponding light spot on the ceiling would go out so you could easily tell which one it was. The only one that I have seen was made by a professional astronomer and it took him five years. Obviously the kitchen variety isn't going in for that kind of a job.

Barney Stones

6227 Stillwell,
Pine Lawn 20, Missouri.

There is one—it's called the Spitz Planetarium and works fine!

Dear Mr. Campbell:

I find constant reference to Psychoanalysis As-THE-Way-To-Solve-The-World's-Problems appalling. A Washington Periodical* recently printed an article on Freud and his modern-day followers. They showed that modern-day Psychoanalysis cured about two thirds of the neurotics it found. However, they also showed that previous to Freud, two thirds of the victims of mental disorders were cured! One will note that this was at considerably less cost than any Psychoanalyst would charge. Besides, the old sanitariums never deemed Alice in Wonderland as neurotic. But modern man—the poor off-balance guy—pays fantastic rates to his neighborhood psychiatrists to cure nonexistent ailments.

The *Colliers Encyclopedia* contains an article on parapsychology. The Schmeidler experiments at Harvard are a particularly interesting facet of the article. Over a period of three years Miss Schmeidler tested for extrasensory perception in large numbers of people. The participants were divided into two groups; those who didn't believe in psi, and those who did. Each of these groups was further divided into those who their Psychoanalysts termed "well-adjusted," and those who weren't. Those of the first group who were "well-adjusted" tested out below chance expectation. Those of the second group who were "well-adjusted" tested out above chance. The neurotics of both groups tested out along the general level of chance expectation.

One will note that it was Psychoanalysis that decided whether or not the participants of the test were adjusted. Therefore, Psychoanalysis, while useless for its intended purpose, is a perfectly valid test for Psi in an individual.

Dwight Wilcox

12971 Nash Road,
Los Altos, California.

Well—a telepath, after all, could appear very well-adjusted to an examiner, couldn't he . . .?

Dear Mr. Campbell,

Allow me to draw your attention to a contradiction in your July editorial, referring to the properties of the Venusian atmosphere.

On the one hand, Venus is said to have a perfectly opaque cloud layer—"the darkness is absolute, there is no light whatever," "immensely thick insulating blanket."

On the other hand, the atmosphere of Venus is credited with a powerful "greenhouse effect"—the ability, as defined by you—"to trap solar energy by

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**Human Events*, published weekly in Washington.

allowing short-wave visible energy in, but blocking the re-radiation of longer wavelength heat."

It seems to me that you cannot have it both ways at the same time. Either you have a greenhouse effect, and then you need a transparent atmosphere with a lot of infra-red absorbers, such as water vapor, or, to a lesser degree, carbon dioxide—or you have a fifty-mile layer of smog, and this is equivalent to an insulating blanket, but not to a greenhouse. Greenhouses are roofed with clear glass.

The high temperature of the planet's surface, as measured by Mariner II, does not have to originate in solar radiation. It might as well be due to an internal source.

The amount of solar energy absorbed per unit surface of projected disk area of the planet is actually smaller than the amount absorbed by the same area of the Earth. The ratio works out at fifty as against sixty-five, in spite of the smaller distance from the Sun. This is due to the very high albedo of Venus.

V. N. Malinov

II David Street,
Mount Carmel
Haifa

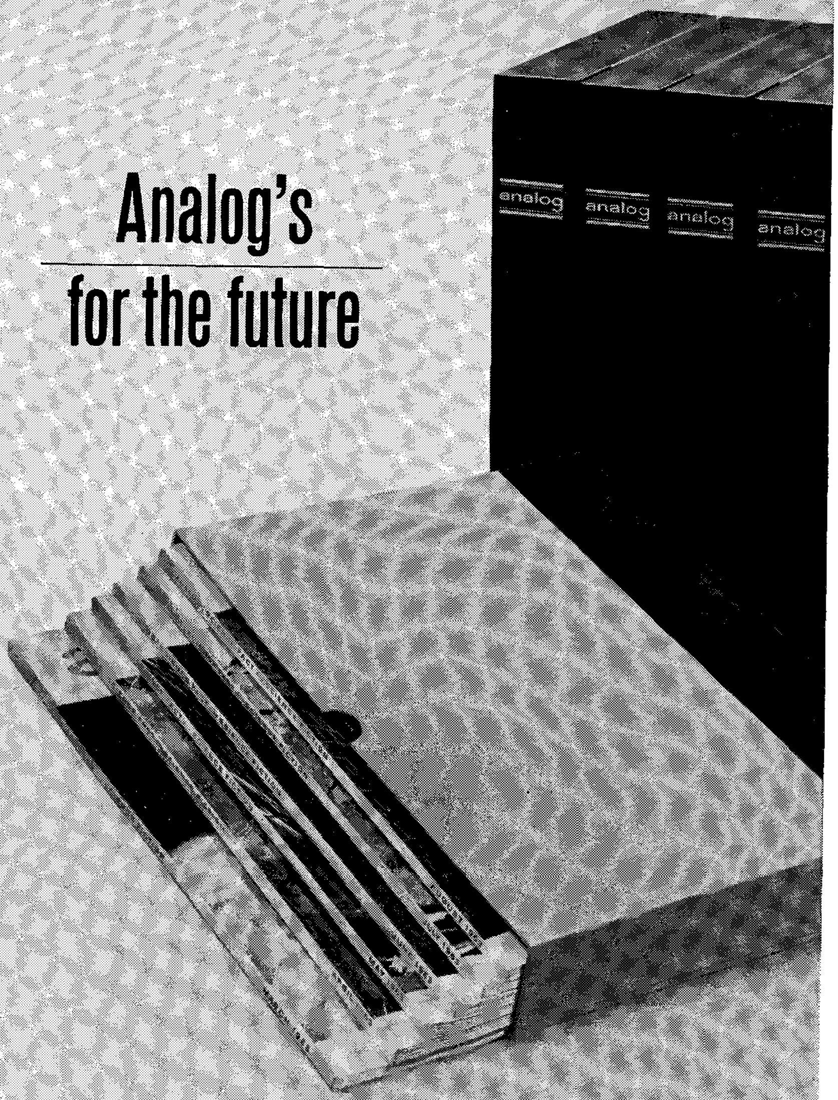
As seen from the bottom, the atmosphere—like our oceans—is totally opaque. But the top layers are translucent.

Dear Mr. Campbell:

I thoroughly enjoyed your September editorial, "The Search for Dynamic Stability." The concept is an interesting one, and I agree with much of what you say; however, portions of the topic need further exploration.

First, Man *did* discover a workable "dynamically balanced culture"—did "crack the problem"—in 1787, but it crashed about his ears when he transformed it from a Republic into a Democracy.

When a mass of legislation is introduced into a dynamic society, designed to control and regulate, the society tends to become static—and then you must go all the way to "Totalitarianism" or it will vibrate itself to smithereens. Obviously, even a dynamic



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BRASS TACKS

society must have laws. But they must be a certain type of law; *definitions* of truth and principle, if you will, and not attempts to *control.*

A law that says the individual must be free to move, since the system requires his motion, will work. But a law that says an individual must move at 45 rpm when the system is driving him at 78 rpm—burdensome taxation!—will destroy the machine, or the individual, or both.

But to return to your editorial, how do you know that the stable societies of 250,000 years ago were "happy and content"? I say there was no such thing as "happy" for the same reason that even today there is no such word as "weather" in the Hawaiian language. When you have no reference point—exposure to an opposite condition—you have no intellectual state—feeling. Kangaroo rats do *not* "like living in the desert," they merely live—in the desert.

The invasions of the barbarians did not spell the stable agrarian's downfall, but his hope for liberation from stasis.

At one point you state that the ideal dynamic cultural system would allow every individual to develop his constructive potentials, and would reward each individual in proportion to his real achievement. I could not agree with you more. This is, of course, the ideal.

However, this type of system—and it exists from politics and sociology to game theory and computer technology—is properly called: reward *and punish.* By definition, if some people advance, others are set—or held—back.

The "liberals" of today cannot accept this. They will not believe that some people must remain behind the van—or there will be no van! (More precisely, of course, no one is "held back" in a free and dynamic society. Individuals of ability forge ahead, bringing the others ahead—albeit more slowly—through their efforts.)

The trend today is in the direction of "static-liberal" thought. Towards an *imposed* — not earned — equality. Equality before the law, equality to try, is fine and noble; but the theory that every man *must be* in all respects equal is an invitation to Totalitarianism.

The Liberals of the eighteenth century understood this. They did not create laws which attempted to force equality, for they knew that such laws must eventually "punish" success and "reward" failure.

Today's egalitarian liberals cannot tolerate the thought of one man freely excelling over another. Therefore, they create new grading systems so that all students can earn a "B" regardless of ability, and they create a Robin Hood graduated income tax, and they turn "profit" into a dirty word. In so doing, they destroy individual initiative—the free man's desire to try—without realizing that it is through the able man's lust for profits and reward that the masses gain indoor plumbing.

Again to return to your editorial, I cannot accept your inference that "happiness" and "security" and "emotional contentment" in a benevolent totalitarianism are desirable, or noble, or even tolerable. Such society is worse than static, it is vegetable. The only "emotional contentment" worthy of admiration results from work, well done, for a profit.

Further, you confuse; "Let's stop here"—a truly reactionary idea—with, "let's not move in the wrong direction." Your statement: "It works, leave it alone" would be better expressed, "let's not force it to do something it was not designed to do." And we must not confuse a *mobile* society with a *dynamic* one; all motion is not progress, any more than change necessarily constitutes improvement.

Despite its complications, the static vs. kinetic theory of social structure has its merit, and I would refer you to Isobel Paterson's "God of the Machine" (Putnam's, 1943) for further study. Your less-serious discussion of the contented ritual-taboo stable societies at the mercy of the individually-free dynamic barbarian deserves less serious study, and I would refer you to a recent *Saturday Review* editorial which blames the invention of wine spirits for the subversion of barbarians into farmers.

If I may contradict you once more, the Declaration of Independence did *not* offer us eternalism, vandal rights, and free circuses; but it did maintain that each Man should be his own master, and be personally responsible for the consequences.

To end on a complimentary note: Your statement that "you cannot have a dynamic system—and have seniority rights, guaranteed pensions, and cradle to grave security," is 100% correct. And three cheers for dynamism!

Jeremy D. Sprague

118 East 19th Street,
New York 3, N. Y.

1. The problem of dynamic stability was NOT "cracked" in 1787. As you say, they tried—and it didn't stay stable, but crashed about our ears. That ain't stable, friend!

2. You, as a dynamic-oriented type, don't understand what "happiness and contentment" mean to a solidly static-oriented type. The static-oriented would find the conditions you want and need a perfect hell—just as you would find his ideal of the changeless welfare state hell. Kangaroo rats do like living in the desert; they can't live anywhere else, and can live comfortably where they are. You don't like living under water, but trout do.

3. The stable agrarian didn't WANT "liberation" from stasis. He hated it. They have, uniformly, fought against it in every instance when it was offered . . . or imposed!

4. Didn't imply I considered the contentment of totalitarianism "noble"; my point was that enormous numbers of men want it, because it makes THEM happy. Heroin makes people feel happy too, doesn't it?

5. An ant colony is a perfect totalitarian order—and like all such 45% have no goal, 30% do it wrong, and 25% are productive. A perfect Carnot cycle heat-engine is about equally inefficient—even if it is perfect!

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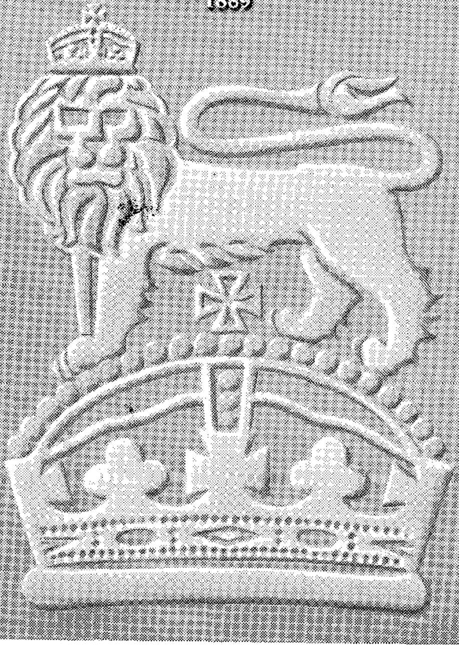

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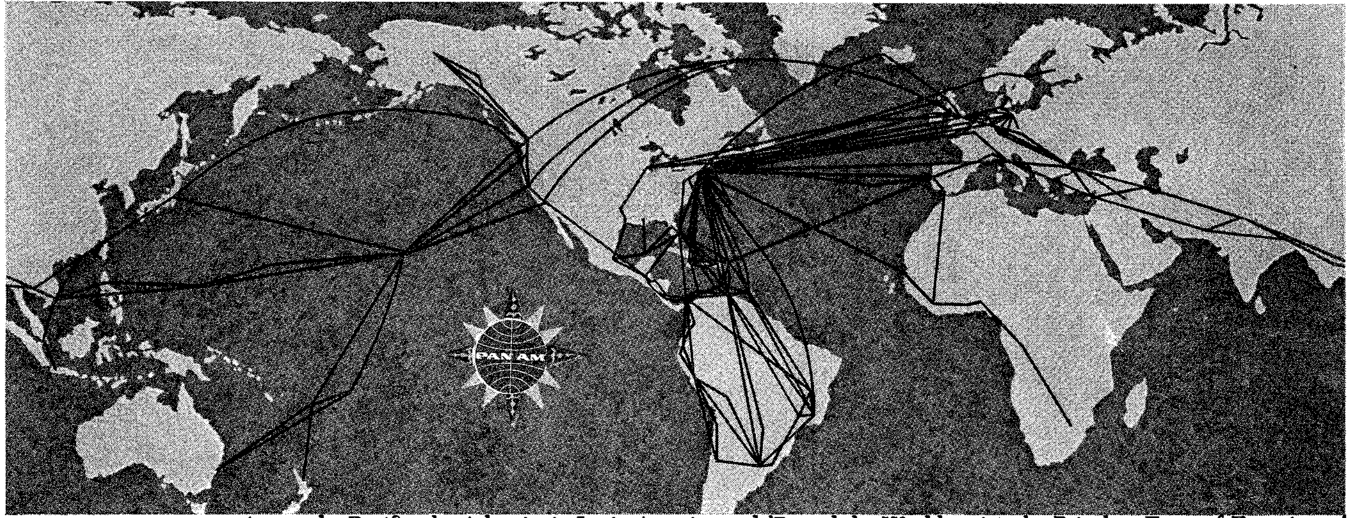

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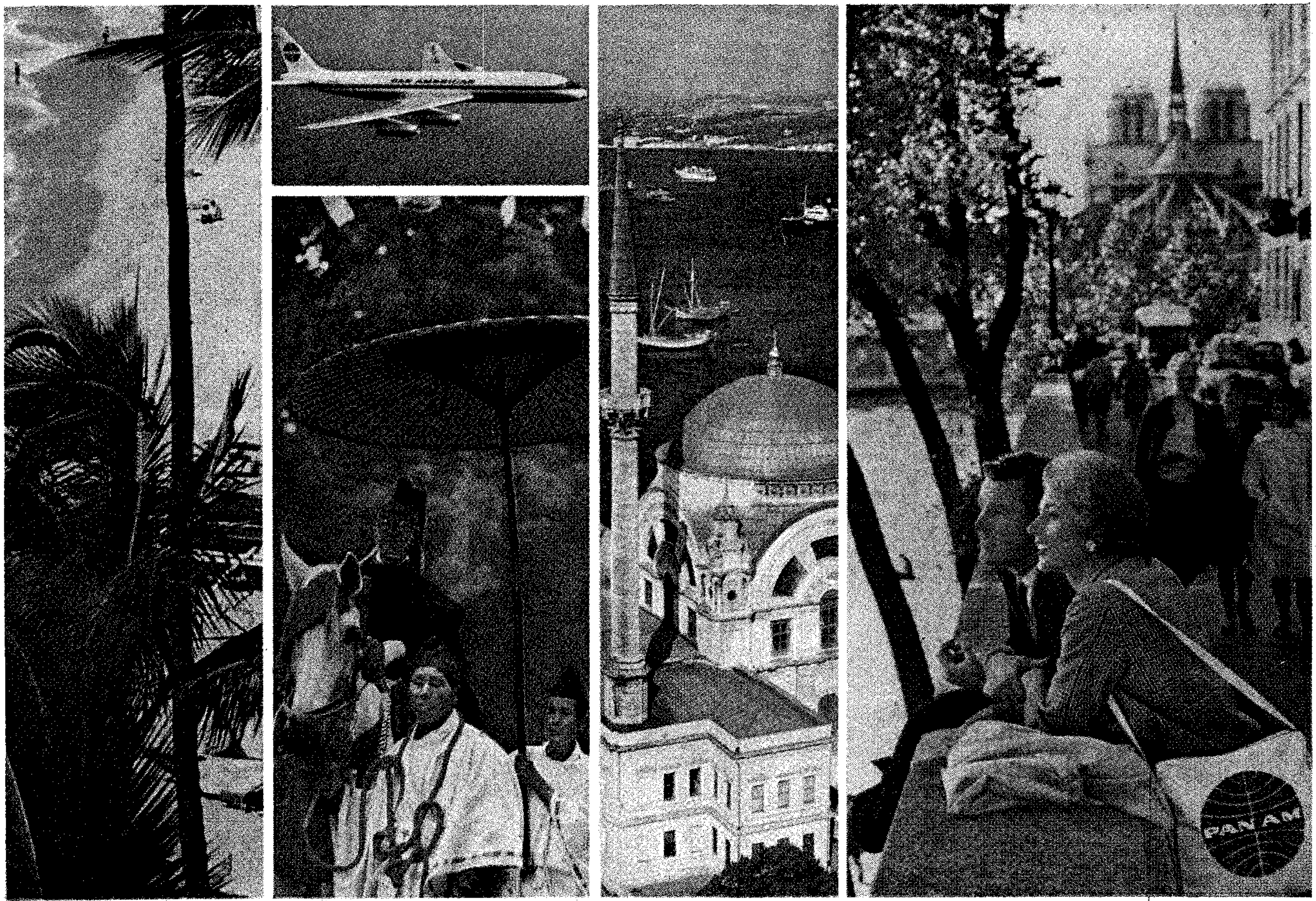

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